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HOUSE OF LORDS SESSION 1993–94

SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

PRIORITIES FOR THE SCIENCE BASE

EVIDENCE RECEIVED SINCE 1st AUGUST 1993

Printed pursuant to the Order of the House of Lords *of 23 November 1993*

LONDON: HMSO

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HL Paper 12-II

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Wellcome Centre for Medical Science

LONDON: HMSO
£15·25 net

HL Paper 12-II

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HOUSE OF LORDS SESSION 1992-93

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TAKEN BEFORE

THE SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

SUB-COMMITTEE I PRIORITIES FOR THE SCIENCE BASE

Wednesday 20 October 1993

BRITISH TECHNOLOGY GROUP

Mr Ian Harvey

Printed pursuant to the Order of The House of Lords *of 19th May 1992*

LONDON : HMSO
£4·10 net

HL Paper 82—xiii

WEDNESDAY 20 OCTOBER 1993

Present:

Butterworth, L.	Flowers, L. (Chairman)
Dainton, L.	Porter of Luddenham, L.

Examination of witness

MR IAN HARVEY, British Technology Group, was called in and examined.

Chairman

797. Mr Harvey, it is good of you to come along at such short notice.

(*Mr Harvey*) Thank you, my Lord Chairman. I appreciate being invited here to give evidence. I should like to give a very quick review of what BTG currently is and what it does. Our business is technology transfer. However, "technology transfer" is a very broad term particularly as we hear that term used today. We are only one part of the technology transfer jig-saw. More narrowly defined, we commercialise technology. Even more narrowly defined, we manage intellectual property (IPR). We identify technology at a very early stage of development. We develop it, update it and patent it and license it. We defend it in court. When a technology is successful it will be infringed. We monitor the progress of our licensees to make sure that they pay us and therefore our university sources the royalties which are due. Our business is a very long-term and high-risk one—more so than the venture capital industry. What is not often realised in this country is that we are the largest and most successful patenting and licensing organisation anywhere in the world, public or private sector. We are the only such international technology transfer (patenting and licensing) company anywhere. The United Kingdom has been very successful in patenting and licensing academic technology. One indicator of this is provided by a comparison between ourselves and the United States. For example, in 1989 and 1990—the last two years for which we have figures—according to data from the General Accounting Office in the United States, supplemented by data from the Cabinet Office here and MIT, the total licence income from US universities and civil research in government laboratories amounted to about $120 million. In the same years, revenues from academic inventions in the United Kingdom, combined with the royalties from academic inventions in the government sector, amounted to over $100 million. Of that $100 million, BTG accounted for over $96 million. Strathclyde, which is the largest other single entity we can identify, amounted to over $5 million. [*Note from witness:* United Kingdom universities do not often separate royalties in their accounts.] In the same period, US civil R&D in the public sectors was around $50 billion. By comparison the United Kingdom was about $10 billion. By that measure, we in the United Kingdom in those two years generated roughly five times the licence revenues from academic technology per dollar spent in the universities than the United States. We believe that the comparison is even more in our favour when we look at almost any other country in Europe or Japan. The United Kingdom is very successful in generating revenues from patenting and licensing.

798. I said that I would not interrupt but what you have said is most interesting. Could you possibly indicate whether that large factor is thanks to you or thanks to the universities, or is it a mixture of the two? In a dispassionate way can you say why it is you have been so successful?

A. I think there is a positive factor on the United Kingdom side and a negative factor on the United States side. On the positive side, I think it is clear that BTG is the largest organisation of its kind in the world, let alone the United Kingdom. We have taken the international view that inventions which will change the nature of world industry have to be patented on a worldwide basis. We have made sure, as we have in the case of magnetic resonance imaging, that the rights of United Kingdom researchers are protected irrespective of which companies eventually develop the technology. By comparison, in the United States, in part because of US patent laws which encourage publication with a period of grace, in many cases overseas patents are not taken out, so information on inventions is freely available (ie for no royalty) to companies outside the United States. Secondly, many American universities find it very difficult to deal with countries outside the United States. We are being asked by many US universities to do their international patenting and licensing for them. I am sure that you will know better than I that BTG was created to protect and commercialise United Kingdom academic technology and create value from it. Just in terms of what has been achieved over the period 1966 to 1992, BTG generated £413 million of royalties. That has not been adjusted for inflation. Of that sum, £270 million, or 65 per cent, was returned to support the research system. We believe that that is a good record. Last year—the first year in the private sector—we generated £26 million in royalties, of which £7.3 million went directly to the universities on a shared basis. That was an increase of almost 50 per cent over the previous year. A further £7.6 million was invested either directly in the universities or on their behalf through patenting. Our total return to universities in the past year has been over £14.5 million. In the first year in the private sector we have made substantial progress in a number of areas. For example, we have licensed 99 per cent of the magnetic resonance imaging industry which is worth well over $1.5 billion. Our patents still dominate that industry. We have reinvested a substantial amount of money in MRI development where it originated with Professor Mansfield. The £2 million MRI high-speed imaging centre in

[Chairman *contd.*]

Nottingham was opened by the Secretary of State for Health about six months ago. We are continuing to plough some of our returns from MRI directly back into the further development of that technology. Today, overall we continue to work on a number of technologies. I know that several times in the House Lord Halsbury has mentioned Torotrak which is a new transmission for automobiles that we have been developing. That is based on an invention by a private inventor. That technology has demonstrated a 15 per cent fuel economy improvement over any other transmission, manual or automatic. We are now entering into discussions and negotiations with a number of the major automobile manufacturers around the world. We have contracts with them for producing prototype transmissions. We have made progress on a broad range of areas. For example, on pharmaceuticals we have over a dozen products in clinical trials. That compares very well with many of the major pharmaceutical firms. Today, our relationship with the United Kingdom universities remains our core business. Thirty five to 40 per cent of all United Kingdom university patents are still filed by BTG. We believe that our reputation is very high, not just in the United Kingdom but also outside it. It reflects the fact that 85 per cent of our revenue arises from outside the United Kingdom, even though 70 per cent of our licences by number are with United Kingdom firms. Whilst the United Kingdom remains our core business over the past few years we have developed a set of skills in the management of intellectual property which can be used to work in other ways. We have begun to work with universities and companies outside the United Kingdom. In the past year, 40 per cent of the technologies offered to BTG arose from outside the United Kingdom, and 40 per cent of technòlogies offered to BTG arose from companies as opposed to universities. For example, in the United States in the past year 400 inventions were offered to us by 80 universities and 50 industrial firms. That compares with what we have today, that is, a portfolio of 1,500 technologies and 500 licences with companies worldwide. To give examples of the universities we work with outside the United Kingdom, the universities of Amsterdam and Neuchâtel. In France we work with a number of institutions such as CNRS. In the USA we work with Princeton, Arkansas, Alabama and the University of California. The companies whose technologies we are handling include: Grumman Aerospace, Eli Lilley, Dupont Merck, American Cyanamid, Johnson & Johnson and many others. If we take just the Johnson & Johnson portfolio, that is now yielding significant royalties to them and therefore also for BTG. We are seeing our skills in the management of intellectual property being recognised and used by significant universities and companies in the United Kingdom and worldwide. In terms of operations, we still remain a London-based organisation handling Europe from a United Kingdom base. But we have what is for us a major subsidiary on the east coast of the United States. We also have a joint venture in India and an office in Japan. Through those various relationships with companies and universities, in addition to licensing early stage-type technology in universities, which is our core business, we license on behalf of companies fully developed products. We provide auditing services for assessment and evaluation of intellectual property in universities and companies. For the small and medium sized firm we offer intellectual property sale and leaseback where we handle the intellectual property on behalf of SMEs and provide consulting advice on IPR and related issues. Because of these broadening operations outside the United Kingdom we are becoming a more significant source of technology for United Kingdom industry than we were before. In many cases, we are seeing the flow of fully developed technology from SMEs and large companies in Europe, the United States and now a trickle from Japan. That is available to those United Kingdom companies which can pick up and run with them. We were privatised in March 1992. Thanks are due to both Houses, but particularly this one, for the fact that the Bill created the right structure for BTG in the private sector. We believe that the three i's—independence, integrity and impartiality—have been preserved and indeed enhanced in the private sector. The shift has left us unchanged in terms of perception within the university sector. As far as companies are concerned, clearly our status has increased, strengthening the way we have been working. Our critical mass has been maintained, that is, the mixture of technologists, patent agents, lawyers, marketing and financial people. We believe that that has been preserved and has been growing, though we have been through a minor staff reduction before reaching that point. It is very important that we have a set of long-term shareholders, including pension funds, venture capital houses and insurance companies—all blue chip financial institutions well known in the City. We have the Nuffield Foundation, the universities and also ANVAR in France. That is helping to open doors to us in the research community in France. That would otherwise not have been tapped into because we were a government organisation. In terms of shareholders, we also have substantial employee participation. You will be aware of the 26 per cent employee share option plan which we believe to be a very important part of privatisation. Although we were privatised into a pretty hostile economic climate we did reasonably well in our first year in the private sector. We bettered our cash flow projections by £2 million and turned round our operating profit by £3 million. We signed 50 per cent more licences than in any of the previous four years. Eighteen months on we appear to be broadly on track but in an economic climate which for most organisations is a pretty difficult one. We also see a very rapidly increasing number of opportunities both in the United Kingdom university sector and companies but also outside the United Kingdom—in Europe and the United States.

799. It seems to me that possibly you have lessons of a managerial kind for industry, especially SMEs. From what you say, you have learnt how to run an inter-disciplinary crew rather well. It seems to me that so many small firms are run by the wrong people and do not know how to employ the rest of them. Surely, you would have lessons to teach them, would you not?

A. I would not be so presumptuous. Our particular business is a very complex one. We are changing and

[Chairman *contd.*]

becoming international in scope. There are a number of companies within the United Kingdom which are examples of best practice, although in many cases there is a long tail of SMEs, for example, who do not compare well with German SMEs. Smaller companies that operate well, like the Willetts or Molins of this world, are world class in their own particular areas. They are the people who operate effectively in teams in an interdisciplinary way. One of the issues that applies in a number of areas is that we Brits are not always good team players. In this world you have to be a team player to be able to bring together in one place all the areas of expertise—not only technology but marketing, production, development and service—if you are to be an innovative firm. We all struggle with that.

Lord Butterworth

800. If I have understood it properly, the implication of it is that you have become even more effective by being privatised?

A. Yes. I refer to the constraints in the public sector, particularly the question of ownership. Before we were privatised many people inside and outside felt that somehow the private sector would be shorter term than the public sector. Our shareholders have shown very clearly that they invest in BTG for long-term value creation. We are in the business of technology transfer. Ever since I joined BTG I have believed that technology transfer is essentially a commercial activity creating value in the market place from technologies which are transferred from whatever source into commercial products. If we do our work well we can capture some of the commercial value which we create. One of the reasons why BTG has been more successful over the years than any other is because most technology transfer organisations have a very mixed set of objectives.

Chairman

801. Turning to our enquiry, the first question is concerned with your reaction to the new mission statements which all the research councils have in more or less the same words. They say that they are to enhance the United Kingdom's industrial competitiveness through their otherwise normal work. Some of them say that they have always tried to do that. Do you think that making that into a formal mission statement will have any effect? If so, what? As a formal requirement, how do you think effect will be given to it?

A. I think that that ties in with the process created by the White Paper that we are in the middle of. First, I believe that the White Paper has stimulated a very healthy debate on the role of science and technology in wealth creation. Second, the relationship between wealth creation and science and technology is not always one that was easily talked about three or four years ago. I think it is now widely accepted that it is an important issue to debate. I believe that the White Paper has done several things. First, it has legitimised the debate. It has reinforced the level of excellence that is in the United Kingdom science base and shifted the discussion to how to increase the absorptive capacity of United Kingdom industry so that it interacts with the United Kingdom science base more effectively and absorbs the technological innovations that are created, be they in the United Kingdom or elsewhere. I think that that is an entirely healthy debate. In terms of the remit to achieve a greater focus on wealth creation, I think that that also has to be tied into the foresight exercise. What the White Paper is trying to do is take the best of what is there and improve and enhance where possible. The United Kingdom has not done a proper foresight exercise before. If you look at the foresight that is done at MITI or Shell the position is quite different. To take Shell as an example, they develop a 30-year scenario. They do not take a single view of the world but two equally valid views of what the world may look like in 30 years' time. Those views are based on social, political, demographic and scientific changes that may come about. Many people participate in that. Those who are going to use the foresight or the scenario buy into it at a very early stage. They have to participate in the process of creating those scenarios. As far as Shell is concerned it is an 18-month process. After those scenarios have been created there is a further 18-month period when all those who are decision-takers debate with those who have created the scenarios to review and assess the robustness of the decisions and the assumptions they make against those quite different but plausible views of what the world may look like long term. I think that the foresight exercise should not be prescriptive; it should not select a number of technologies or define a single view of the world, but it should set up scenarios of what the world may look like in order to inform the decisions and debate that government needs to engage in in its forward look and the research councils need to undertake in reaching decisions as to which areas to fund.

Lord Porter of Luddenham

802. Before we move on to the "foresight" side of it I should like to deal with the Chairman's question which was concerned with the emphasis placed on wealth creation. With such a successful operation and your long experience you are in a unique position to give and offer advice. You referred to the absorptive capacity of United Kingdom industry. We all want to see that, but what the White Paper says is: "The science and engineering base should be made more aware of and responsive to the needs of industry". That is putting it the other way round. That is not saying that industry should be more aware of research but that scientists should be more aware of it. After all, you are looking at the universities all the time and seeing what they are doing and the opportunities for patenting their work. Do you feel that scientists and engineers in universities are unresponsive to you, wealth creation and industry? Do they say "Boo!" to industry if industry asks them what they are doing? Does something need to be done there? The White Paper uses the words "should be made more aware". Are they unaware?

A. At the margins there remains a need. The United Kingdom has moved a long way from the position it occupied five or 10 years ago. Many more researchers are very much attuned to what the market place wants in the short, medium and long

[Lord Porter of Luddenham *contd.*]

term. Often, their view of what the market place wants may be different from what industry says it needs. For example, we worked on the pyrethrins which were the first environmentally benign insecticides when industry said that it did not want them. We and researchers perceived that social pressures would demand environmentally benign insecticides. [*See endnote.*]

803. With respect, you are giving a very negative answer?

A. I am not giving a black and white answer. I think that benefit can be gained from researchers having closer relationships with industry. In quite a few cases they still do, but that must not mean that all research work has to jump to the demands of United Kingdom industry.

804. Perhaps because industry does not always know its own needs?

A. Yes. To backtrack, yesterday I attended a debate at the CBI where the Chancellor of the Duchy of Lancaster and Bill Stewart were talking about the foresight exercise. All the time one has to be careful not to reduce it to a linear model of what technology transfer is. If one looks at the ESRC Innovation IV paper published a few days ago which looks at the links between industry and academia, they clearly restate what I regard as the essentials of research. First, research is to train people; secondly, it is to add to the sum of knowledge. Occasionally, you may come up with an invention which will be of significant economic value, but you do not do research with the objective of coming up with inventions. If you are to operate in the first two areas and regard them as of principal importance, that is, the training of people and the broad areas of research, then you have universities doing research which, if they interact with industry, will stimulate industry in the direction it wants to go without doing the product development work. That is a very valuable method of interaction. But at the edge I believe that you must also allow a certain amount of blue skies research which is not trammelled by what industry wants.

Chairman

805. It seems to me that that there are two extreme interpretations of these mission statements. One extreme is that a research council will, as it always has done in the past—so it says—judge an application or programme on the basis of its excellence. If it has too many excellent projects to fund it has to make a second choice. Which of those equally excellent projects will it fund? In that second sift it can very well use some ideas of its own or somebody else as to what is more likely to lead to the satisfaction of its mission statement. That is one interpretation. The other interpretation is that somebody such as the DTI, through the technology foresight programme or otherwise, has a very good idea of what he thinks the profitable areas are—in other words, how to satisfy the mission statements—before he has seen any applications or proposed programmes at all. If one takes that interpretation it is likely that one will start dishing out notional moneys against those major headings, with the result that one gets different concepts of excellence developing in different fields. That means that in some fields you back the second rate. You do not have to have either extreme but some mix of the two, but how do you see it working in practice? Is it any different from what we have had in the past? We have selected areas and concentrated activity for many years in the research councils.

A. I do not think that in the past the United Kingdom, in the way choices have been discussed in research councils, has had the kind of long-term view of the way that society, industry and the markets will move. I think that the foresight exercise and perspective will provide a different dimension. It then becomes market pulled rather than technology pushed. I know that that is not always fashionable in the science and technologies areas, but it is commonly said that we cannot fund everything. Keeping a balance between scientific excellence in a number of areas can train people who will go out into industry, even if they do not always achieve the excellence which one may wish to retain for pure research. I think that one has to make a choice between different areas. It should not be prescriptive; it should not be an edict from government that the following 12 technical areas will be covered. That would be very dangerous. The kind of debate that the United Kingdom will have to engage in can be illustrated by research undertaken in the electronics or optóelectronics area where on the one hand we have few consumer electronics firms but a large number of scientists who probably will be shed from the research effort in the defence sector. Yet at the same time we have service companies, such as Cable & Wireless and British Telecom, who are at the cutting edge of either developing technology themselves or buying technology which they need to remain world-class firms. Sitting here, it is very difficult to make a prescription as to what the outcome of that should be, but there needs to be debate on the kind of research that should be done in that area.

Lord Porter of Luddenham

806. You told us how successful BTG had been. It is engaged in a business that we are supposed to be bad at, that is, the transfer of science and technology from universities to industry in general. What is the secret of that success? How do you find these projects? Is it push or pull? Do you go out to universities to seek them or do university scientists come to you?

A. It is a combination of push and pull. We aim to be informed about market needs and wants in each of the areas in which we operate. For example, in the pharmaceuticals area we talk with the top 50 pharmaceutical companies at least once a year, and probably more often. We talk with the second rank companies at somewhat lower frequency. In that way we have an overview of what industry wants and the problem it needs to have solved 10 to 20 years ahead. With that knowledge at the back of our minds we identify individual excellence and centres of excellence in the United Kingdom and increasingly overseas where we believe that research is being done that is likely to throw up ideas of commercial significance. About two-thirds of the inventions that we take on result from our going out to look for that

[Lord Porter of Luddenham *contd.*]

technology; one third come from people who know us through our reputation and put forward an idea. The fallout rate of those ideas which come to us free standing is much higher than the fallout rate of those ideas which we ourselves have identified. I stress that in terms of technology transfer what we do is only one part of the jig-saw. In technology transfer it is not only the individual ideas which are important. It is the combined research projects which companies fund in universities and the interaction between university researchers and company researchers which can be very stimulating to company researchers in heading in new directions, identifying opportunities or identifying breakthroughs when they have taken place outside the United Kingdom. I believe that in terms of wealth creation in the United Kingdom that is a more important part of the technology transfer process.

Chairman

807. The worry that most university research workers have is that, rightly or wrongly, they believe that the sort of research which, say, is likely to be funded by industrial contracts, if that is the way our research is funded—fortunately, it is not—will not be as far-sighted or interesting or to lead to development as the work they do in a traditional way by thinking about their subjects and saying, "How can we develop these?" They may be right or wrong, but you are in an excellent position to look at it and say what you think should happen.

A. I think the reality is that much of the research funded in universities by companies is a healthy mixture of focused and blue skies research. Of the researchers that we have seen, many of them are stimulated by new dimensions and the questions that are posed by industry. Clearly, there are areas where research has been prescriptive and very narrowly defined. I think that more work has been done in the United States than here in looking at what is and what is not successful. Work has been done at MIT on the question of what is the most useful form of interaction. For example, straight funding of university research by companies is less satisfying to both sides than periods of research done partly in the universities and partly in the company itself because the interaction of research workers is a very creative process. By and large, we find that researchers are stimulated by the kind of problems that industry has. Provided that the balance can be kept by putting relevant research alongside blue skies and fundamental research a very exciting process is in place.

Lord Porter of Luddenham

808. Is the balance reasonable now or should it be changed? We are told that we are very bad at doing this.

A. I think that we have further to go in encouraging United Kingdom industry to invest in universities in the United Kingdom or outside it. Properly done it can be a very creative process. Our world-class companies like Glaxo, ICI, Wellcome and so on invest significant amounts of money in United Kingdom universities as well as overseas. Our experience is that that is a very productive relationship.

809. On the other hand, would you say that scientists are in an ivory tower or unhelpful in aiding investment? That appears to be the implication of what you say.

A. That would be the wrong implication.

Lord Butterworth

810. If I remember correctly, earlier you said that two-thirds of your company's time was spent in going out to universities to find out the kinds of things that industry needed. Have I put it correctly?

A. Not quite. Two-thirds of the technology that comes to BTG is technology that we have stimulated because of BTG's knowledge of what industry is looking for, but that does not represent two-thirds of our time. We spend between one quarter and a third of our time searching for technology.

811. Accepting that correction, if that is so does it lead to the view that some part of each research council's efforts, if it is to follow its new terms of reference, should be to offer grants to researchers in universities in respect of work which it knows industry needs to have undertaken?

A. Provided it is not taken to extremes I see nothing wrong with that.

Lord Dainton

812. That brings us naturally to the question of mechanisms for achieving this. To a considerable degree our attention is directed to the White Paper. In view of what you have said, I am bound to ask whether you think that this voice should be represented in the decision-making machinery and, if so, at what level or levels. Do you think that the views you have expressed should be represented at the Council of Science and Technology level? Should you be at the right hand, through the advisory committee, of the director general of the research councils? Should you be on some of the research councils? The proliferation of those councils makes that difficult. What is your view on that?

A. When you ask whether we should be represented, are you asking about technology transfer?

813. In view of the fact that technology foresight is given such dominance in the research council missions and your experience of moulding academic work and shaping it in directions that lead to technology at the end of the day, do you think that you have a specially important voice that should be heard at those levels?

A. I would not be as presumptuous to say other than that we have very good experience in identifying valuable technology when it arises. That is only one part of the technology transfer process. I do not wish to suggest that that should necessarily be a dominant one, otherwise we risk falling into the linear model of technology transfer.

Chairman

814. Lord Dainton is asking whether you have a policy input as well as an input of expertise?

A. We would like to have a policy input. We shall be co-operating with the various research councils, making ourselves available to make that kind of input.

Lord Dainton

815. It seems to me to be very useful to have somebody who covers a very wide range of subjects rather than what you are likely to get from people who are specialists in particular fields.

A. That having been said, we are a small organisation of 150 people. We have to be careful that we do not spread ourselves too thinly.

Chairman

816. Can you give us a measure, however rough, of what proportion of research council activity you are playing a part in or are involved in? Are you involved in a lot of what the research councils do, or is your interest in the research councils' efforts only marginal? In the one case you have the right to be heard policywise; in the other, perhaps you do not.

A. Our interest is marginal in the sense that the number of technologies which can be patented and create real value in the market place is quite small as a proportion of the total amount of funding going into the research councils. On the other hand, we are patenting about one third of the number of technologies emerging from the United Kingdom universities. In terms of exploitable ideas we believe that we have a very significant role to play. We would be disappointed if we were not in a position to make a contribution to the debates that have to take place.

Lord Dainton

817. The problem that will be faced by both the director general of research councils and the Council of Science and Technology will be the making of choices. My point is that you cover a very wide range, whereas it is likely that many people whose places at those tables would seem to be assured will be speaking for very narrow areas because of lifelong experience at taking such views. That is a good and justifiable thing. Our enquiry is concerned with the priorities for the science base. In that situation there is a need to balance one option against another. It seems to me that it is very difficult to achieve the highest possible rate of success—it has to be recognised that there will always be failures—unless somebody can take a well-based overview. Do you agree with that?

A. I would agree with that. There are a number of ways to deal with that. To take one example, when the IRC and the national committee on superconductivity were being formed, we believed it would be helpful to take a worldwide view of what patents had been filed and where the interesting areas were, indicated by the kind of patents that had been filed, or whether there were commercial opportunities for the United Kingdom to operate where patents had not been filed. We believe that an opportunity was missed. That specific input into particular areas is almost as valuable as trying to take a global overview and make judgments between areas, which is very difficult to do.

818. That helps me to make a point and get your opinion upon it. When I looked at that particular area everybody was chasing a higher Curie temperature. It always seemed to me that the gap was other than what had been defined. What we wanted was a material which had a reasonably good Curie temperature but was wire-drawable and windable around magnets and metal. That was where people could have an influence or niche. Would that be the sort of view you might want to urge?

A. That would have been one of the views which would have been helpful at that time. It is one of the views that we have followed. For several years we have been working with a researcher in Cambridge and following exactly that route.

819. It is really a matter of discerning the areas that are likely to be useful and connecting them with the basic research which is your stock in trade?

A. Yes—knowing that you are making these judgments at a very early stage in the process. Many judgments will prove not to have a positive outcome. They should not be called mistakes. You have to have a number of irons in the fire so that when the market develops you have a significant number of entrants in the markets which materialise.

Chairman

820. You have said quite a lot about the technology foresight programme. You see it creating a sort of vision within which everybody derives some inspiration about what they want to do. I do not know whether you wish to say any more about it. I would be satisfied if that was your view.

A. That is my view. I would add that my very firm view is that the foresight exercise should not be prescriptive. It is a process, and the process is almost as important as the outcome. You draw people into the preparation and dissemination of it. It is that interaction which creates the real insights. Often the insights which are likely to create value arise at the interstices between technical or scientific areas.

821. Provided it is done by people in the game and not by people outside it.

A. People outside often create the stimulus and ask the difficult questions which those who know the technology very well may not see for themselves. For example, in the Shell scenarios it is noticeable that there is a very broad mix of thinkers, such as technologists, economists and demographers. Provided you have the openness of debate, and not the occasional committee meeting of members who do not know each other, but people who can throw out ideas and let those ideas build on each other, you will come up with views of what the world may look like and generate some of the outrageous ideas which compare with the kind of outrageous changes that the world has been through in the past five or six years.

822. But we do not want a branch of the Civil Service manned by professional technological seers, do we?

A. Someone has to organise the process.

Lord Dainton

823. You are speaking of a forum for these discussions. Where should that be in the structure that is envisaged?

A. It is in OST at the moment. Providing they are not prescriptive, I think that the way they are developing is very positive. I believe that the Chancellor has done a very good job in terms of selling the concept and drawing it out as a process.

824. Much of that concept came from the DTI, did it not?

A. I think that much of it came from ACOST. We did a long study on foresight which emerged just as OST was beginning to take on board the foresight concept.

825. To implement it means some slight but nevertheless important redistribution of funds which may occur between research councils from time to time perhaps by co-operation. Do you think that the present structure is likely to be able to provide that? If not, in what way should it be improved?

A. There will always be interstices, gaps and overlaps between the research councils. From the discussions I hear I believe there is a good deal of willingness in the system to collaborate fairly closely and not to be too competitive. The team approach is a very positive sign emerging from the White Paper.

Chairman

826. Perhaps I misunderstood it, but my concept of technology foresight was that it would be some kind of inspired interaction between government departments, not just the DTI but agriculture and others, concerned with scientific R&D as users or proxy users, and the same would apply to research councils, universities and industry as well. It is not just a matter for OST. No doubt they will organise it and bring the forum together, but how do you see the interplay, especially the relationship between OST and other government departments?

A. OST will be the facilitating group, but I hope that there will be a market sector area which will develop scenarios for each of the market sectors—healthcare, telecommunications and so on. Those will need to look at what the technological possibilities are, but the driving force becomes the market sector rather than the technology. I think that some of the first ideas coming out of the proposals were to look at technology sectors and use those as the driving force centres. I believe that the process has moved and is continuing to move away from that.

Lord Porter of Luddenham

827. Does it really differ from ACOST? What is the difference between ACOST and COST?

A. Lord Porter is probably more perceptive as a former member. I think that one is a development of the other.

828. It is roughly the same number and same mix of people. It has lost its "A" and is not advisory any more. In what way is it different?

A. First, the way it is different may depend on the kind of voice and linkage it has into government. Secondly, I think it is different to the extent it undertakes studies itself. As I understand it, COST will perform fewer studies itself and have a more advisory role. It will direct and advise in relation to the other things that are going on. That may free up some thinking time. Perhaps ACOST did get very heavily involved in detailed studies.

Lord Dainton

829. With whom will lie the fundamental responsibility to ensure there is sufficient thinking time to get it together?

A. I think you will have to ask Professor Stewart that question.

830. In that case, where should it lie?

A. I think it lies with the chairman of the Council.

Chairman

831. In the past we have had generic technologies and strategic areas of research which have been preferentially backed by government at different times. Different governments have had different ways of doing it. All of those concepts have been based on some longer than short-term vision of how things are developing. Sometimes they are subject-based rather than industrial-need based. What is the technology foresight exercise going to do that has not been done many times before? If one takes the United States, in the 'sixties and 'seventies there was "research for national need", or whatever it was called. They tried to have a vision of what the world would be like, what industry would need and what the consumer would need in the future. On the basis of that the R&D programme was developed. What happened to that? Is the same thing going to happen to technology foresight?

A. There is a significant difference between the way views on areas of importance have emerged in the past, which have been basically derived from studies by the DTI or elsewhere and have been prescriptive in nature, and the foresight process. The foresight process is one which creates a vision of the future against which many people will make their individual submissions in research councils and government departments. One is looking not necessarily at specific, well-defined, coherent policies but policies which are internally consistent given what the future may bring. One can only hope that with the dispersion of decision-making amongst the many rather than the few leading to a narrow selection of areas on which we will focus attention, the areas of research will encompass those areas of future importance to the United Kingdom. However, one cannot be certain about it.

Lord Dainton

832. The trouble is that when you do it that way you find that there is an almost endless series of areas of opportunity. We all know that we cannot pursue them all. In any event, if you spread the money too thinly you do not do anything well. I come back to the point that somebody has to make choices. Somebody perhaps in the new BBSRC has to say, "These are the areas which for the following reasons we believe are awareness areas". There will have to be a smaller number than the maximum possible that you have thought of in the first place. One comes back to the problem of choice. How is one to narrow

[Lord Dainton *contd.*]

it down given that we contribute only 6 per cent of the world's research?

A. I would have thought that the first level of guidance would come from the director general of research councils and individual decisions as to areas to be followed would be made by each of the research councils. I would be disappointed if that freedom was not there.

Lord Porter of Luddenham

833. The technology foresight would be a parallel matter?

A. It would be an informing process to the decisions of the research councils.

834. The director general initiates it and it comes down to the research councils?

A. Yes.

Lord Dainton

835. The inevitable consequence of that is that the research councils in thinking of those areas to which they wish to respond will agree and say, "Yes, but it will cost you". That will have to be reflected in some way by a system of giving and taking away resources. Where should that decision lie?

A. Over time, with OST and the director general of research councils.

Lord Dainton] One is really welding together the research councils as if they are divisions of a unified research council.

Lord Butterworth] Putting it another way, are you implying that the first task of the director general would be to call on the research councils to surrender their royal charters?

Chairman

836. They do not have to. The question is whether the director general's job is to "direct generally", never mind how he does it.

A. Yes, it should be, but one would be looking for evolution rather than revolution.

Lord Dainton

837. I am sure you would agree that in times when money is scarce—and it will be scarce for some time—somehow what is available has to be distributed in a most effective manner. In hard times the research councils want to maintain their size, opportunities, staff and everything else. In the nature of things they will want to bid for it.

A. I am sure it is right that there should be that debate. Research councils will have to justify their bids. That debate in itself, in the context of the wider issues, should be a profound one.

838. But the buck will stop with the OST and the director general of research councils?

A. In its current structure that is how it appears to me.

Chairman

839. A related point is the boundaries between research councils, which have just been redrawn, in some cases in my opinion not entirely correctly. It does not really matter where the boundaries are if they operate as divisions of a single outfit and if the director general really generally directs, but if in reality they are independent in time the boundaries will become absurd, even if they are not absurd now. Have you any views about where the boundaries are being drawn according to the White Paper? Do you think it will be helpful or unhelpful to you?

A. We participated in the comments which were asked for by Sir David in the boundary study.

Chairman] So you are to blame!

Lord Dainton

840. Or to be congratulated!

A. In my discussions with a number of people operating with the research councils the boundaries which have been drawn are broadly sensible ones. There appears to be a willingness to co-operate between research councils and a recognition that there will be overlapping in grey areas. Although the total framework is not yet in place, there seems to be an intention to work in a co-operative way. If that can be maintained I think that it will be a constructive change.

841. In those circumstances who do you think will look at the health of a given discipline which is distributed over a range of research councils?

A. Broadly, the disciplines will rest within the research councils. I cannot bring to mind a discipline which will cross over.

842. We have one example in this House of an area which was totally neglected just when it was needed. I am thinking of systematic biology research. It seemed to be nobody's business though it was everybody's.

A. In this case I would have thought that that responsibility would rest with the director general of research councils and ultimately OST.

843. He has to make a constant review of the research council activities year by year?

A. You do not want to pull up the plants too often to see if the roots are still growing.

844. But you have to watch to make sure they are growing?

A. Yes.

Chairman

845. We have heard it said that universities are becoming rather greedy or unrealistic about intellectual property rights, or over-optimistic about exploitability, with the result that their normal academic work is being somewhat undermined by commercial confidentiality. From your experience, do you think that that is a justified criticism?

A. Clearly, some universities and UDILS may have set their expectations too high or unrealistically. Our observation over the past three or four years is that the calibre of the UDILS has improved significantly. Many of them however still do not have the breadth of technical, professional or commercial experience in order to do the patenting and licensing job themselves. That is why a substantial number of UDILS are now working very closely with BTG. We are seen to be the professionals in international

[Chairman *contd.*]

patenting and licensing. They use us for that area, just as they will use an external law firm for writing contracts with industrial firms for research. We have always said that there need be no significant conflict between patenting, exploitation and publication. That remains our view. Patents can be obtained very quickly. Maintaining commercial confidentiality with no publication at all is by far the exception, it is certainly not the rule.

Chairman] Thank you very much. This has been a very exciting and informative session.

Note from witness on Q. 802: Time proved us right. However patents and technology transfer is very high risk, and only a small minority of patents and inventions will be real commercial successes.

Printed in the United Kingdom by HMSO
19585 C5 11/93 131838

HOUSE OF LORDS SESSION 1992-93

MINUTES OF EVIDENCE
TAKEN BEFORE

THE SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

SUB-COMMITTEE I PRIORITIES FOR THE SCIENCE BASE

Thursday 21 October 1993

SCIENCE AND ENGINEERING RESEARCH COUNCIL
Sir Mark Richmond and Mr J Merchant

ECONOMIC AND SOCIAL RESEARCH COUNCIL
Professor H Newby

AGRICULTURAL AND FOOD RESEARCH COUNCIL
Dr B Jamieson

NATURAL ENVIRONMENT RESEARCH COUNCIL
Dr E Buttle

Printed pursuant to the Order of The House of Lords
of *19th May 1992*

LONDON : HMSO
£4·10 net

HL Paper 82—xiv

THURSDAY 21 OCTOBER 1993

Present:

Flowers, L. (Chairman)	Selborne, E.
Porter of Luddenham, L.	

Examination of witnesses

SIR MARK RICHMOND (SERC), MR JOHN MERCHANT (SERC), PROFESSOR HOWARD NEWBY (ESRC), DR BRIAN JAMIESON (AFRC) and DR EILEEN BUTTLE (NERC), were examined in the offices of the SERC at Polaris House, Swindon.

Chairman

846. I think I would like to start off, if I may, by just asking you in the broadest possible way how you react to the White Paper.

(*Sir Mark Richmond*) You know who we all are?

847. Yes. Maybe not everybody does.

(*Sir Mark Richmond*) I have with me John Merchant who is the Head of Administration in SERC.

(*Dr Jamieson*) I should perhaps explain that I am the Director of Administration of AFRC. Professor Tom Blundell is sorry he could not come this afternoon but he had a long standing engagement in Scotland.

848. I would like your reactions, either singly or collectively, to the White Paper in general terms before we start.

(*Sir Mark Richmond*) Shall I start? I think it is an advance in that it clearly indicates some Government policy in the area where I think many of us felt until the OST was set up and the White Paper was produced there was very little evidence of Government policy, at least since 1979. I think as far as SERC is concerned, and its daughter councils, it certainly clarifies a number of issues in a helpful way. It resolves the dilemma which we have had over the last few years as to whether we were supporting research in universities, which as you know from your days, Chairman, was the primary function under the 1965 Act, an aim that had become considerably distorted by schemes like Alvey and LINK where the mission was basically to underpin wealth creation. We now have that resolved and I think that is helpful. It sets a framework. Will it work? It will work in part. It is going to, but I think it will take a number of years really to bed in. I think a great deal depends actually on the extent to which people are really prepared to take it forward, or the extent to which in the face of opposition, and I think there will be opposition, the Government does not press the issues. The advantage of the White Paper is that it is a clear signal that Government now has noticed science and technology in a positive way. The risk is, of course, there is lurking there now a much greater and direct political involvement.

Lord Porter of Luddenham

849. Could I just ask Sir Mark, I do not quite understand why you said it was resolved. You said it used to be that its purpose was to support research in universities and then it became with Alvey and so forth the support of wealth creation and thank goodness this is now resolved. In what way is it resolved?

(*Sir Mark Richmond*) I meant to say that the initial reason for SERC was to support research in universities. As the years went by various schemes were introduced and inherited by SERC, political initiatives, which had as their main mission wealth creation.

Chairman

850. That was peculiar to SERC.

(*Sir Mark Richmond*) Yes, that was peculiar to SERC. Now the White Paper resolves that in that our mission is no longer to support research in universities, our mission is now to support wealth creation where we can do it best which may be in the universities or which may not.

851. Yes. That is an improvement from your point of view perhaps?

(*Sir Mark Richmond*) A clarification.

852. Not necessarily from the point of view of the universities.

(*Sir Mark Richmond*) The question now is the extent to which that is carried through in terms of the structures and the processes put in place; to see whether it comes to fruition.

853. You could interpret your mission statement, or at any rate the White Paper, to give you a green light to set up research institutions all over the place in preference to supporting work in universities. There is nothing to stop you in law.

(*Sir Mark Richmond*) No, that is absolutely right. Indeed, some of the research councils—MRC—fund much more work through institutes. It has to be said in various informal conversations one has had with David Phillips he would greatly have welcomed the development of an MARC type approach within the SERC.

(*Mr Merchant*) We were never formally banned—the SERC—from setting up institutes under our present charter.

854. No, I know, but there has in the past been great pressure on all research councils, it was not necessarily the SERC although it was sometimes, not to forget their duty to support the universities but now under your new mission statement there is no such obligation.

(*Sir Mark Richmond*) That is correct.

Lord Porter of Luddenham

855. And you do see it as a clear signal to which you will respond and provide less support for research in universities?

(*Sir Mark Richmond*) No, I did not say that. What I said was that now we have the job of supporting our mission, and presumably the extent to which we are successful in pursuing that mission is the extent to which we underpin wealth creation.

856. Could I just, if I may, repeat the question. Do you think that will lead to less support for research in universities?

(*Sir Mark Richmond*) I do actually because I think we will in future receive applications from a much wider range of people, Government research establishments. And with the number of Agencies building up, and with bodies of that kind associated with Government but at arm's length, it is very, very difficult to draw the line as to where the private sector begins. If you have a company limited by guarantee or a company with, say, DTI owning all the shares is that in the private sector or in the public sector?

Chairman

857. Do the others of you feel much the same? We are interpreting the White Paper at this stage.

(*Dr Buttle*) I would take a slightly different view, I think, to the extent that our mission fully states that we should support basic research. I interpret it as being support of basic, strategic and applied research claims. We are in effect creating a library, we have always been creating a library of knowledge, and we have been concerned to ensure quality control of that library and also that it covers the full panoply of the knowledge base. I think what we are being encouraged to do, if I can continue this analogy, is to encourage others to read those books and not in any way compromise the quality of what is available. I think it is a question of balancing and forming links and opening the minds of those doing the basic science through the opportunities that can develop.

858. That goes right on to Lord Porter of Luddenham's point yesterday, that the White Paper says that scientists must be made to realise the advantage of wealth creation, but there is nothing about industrialists being made to be aware of the advantages of science. It is rather one-sided.

(*Sir Mark Richmond*) The piece that is missing, I think, is a White Paper sponsored by the DTI on how the science base is pulled through into the industry. This is all about technology push.

(*Professor Newby*) It also has to be said that I think all the research councils would be addressing this issue anyway irrespective of the White Paper because of the changes going on in the universities. A number of us, certainly Mark and I, have discussed this on a number of occasions where because of the pressure on universities taking more students, the danger of eroding the science base in a number of universities is there and we would have to be thinking quite seriously about the point at which we would be saying to ourselves that increasingly universities are not places where we can fund leading edge research, we might have to set up institutes or some other mechanism alongside universities because of what is going on in the universities. We are not there yet but it is a scenario that has occurred to a number of us.

(*Sir Mark Richmond*) I think my colleagues disagree but let me say, to my mind, a huge amount is going to depend on the extent to which the peer review system is adjusted and in what way it is adjusted to reflect wealth creation; and the extent to which the funding councils change their view of what they regard as good research, particularly during the next research selectivity exercise.

859. My memory, and it is a long time ago now, was that SERC was entitled, empowered, to give money to an industrial firm but we never did.

(*Sir Mark Richmond*) We have had a self-denying ordinance in certain respects.

860. There is nothing to stop you.

(*Mr Merchant*) There is nothing in our charter which stops us giving money to industries, no.

861. But now you think it might be the intention?

(*Sir Mark Richmond*) The question has been asked whether the new research councils must consider a grant application from someone working in a private sector research laboratory and the answer tends to be—this is all informal—"No, we do not expect this to go as far as the private sector" but then you ask questions like is AEA Harwell in the private sector and all sorts of problems begin to emerge.

862. Or there might be a sort of Faraday Centre set up close to an industrial science park.

(*Sir Mark Richmond*) Yes.

(*Dr Jamieson*) There is quite a large developing twilight zone of such bodies and we are under pressure from Government, and internal pressure, to open up our research grant schemes. I think this applies equally to all the councils. We in AFRC, soon to become BBSRC, are quite happy to do that as long as we are still able to judge applications on their merits. One of the problems and one of the impediments is the basis of costing because there is not really an equivalent of the dual support mechanism that applies to universities in some of these other organisations.

863. You might have to make it a condition that they found such a system.

(*Dr Jamieson*) We might have to do something like that.

864. Otherwise some of your removing support from universities would be unfair.

(*Dr Jamieson*) Yes. We are striving to introduce this wider competition on a fair basis.

865. I do not think we want to talk with you at this point about what your actual boundaries are going to be, that is another issue, but I have always suggested, and several of my colleagues have suggested, that there should not be any boundaries at all and we would have preferred to see a single research council with a question mark over medicine. Under the new regime your efforts will be co-ordinated by the Director General of the Research Councils. If I were in your shoes faced with the White Paper I would have guaranteed that the Director General could do nothing whatever. Have you done that? He does not have any powers at all, does he?

(*Sir Mark Richmond*) Yes, he will have I think.

866. What?

(*Sir Mark Richmond*) I think he will actually end up "in the line" and I think he will end up in the line

[Chairman *contd.*]

not through some of the more obvious ways but through the terms of the Resource Management documents of the Research Councils who will be required, for resource management purposes, to consult and indeed follow the advice of the Director General.

867. A memorandum of guidance?

(*Sir Mark Richmond*) We have got two things here, a financial memorandum—

(*Mr Merchant*) There is a financial memorandum and something called a resource management agreement which governs what we can and cannot do within our own powers.

(*Sir Mark Richmond*) I think we will find that we will have to consult the Director General of the Research Councils before money is used for certain purposes.

868. I originally pressed for him to be an accounting officer jointly with each of you. It has been said, after the event because the White Paper is there, that actually there is no need for that, all that is necessary is that his advice to the minister should be published and that the minister's decision should be announced in sufficiently clear terms that you can judge whether it has been followed or not. If that becomes the practice then the Director General to all intents and purposes is a rather important character.

(*Sir Mark Richmond*) The signs are not good in that he will be appointed, unlike David Phillips, formally as a civil servant and what he publishes or what he does not publish is a matter for the minister whereas with David Phillips, my reading of the position is if he wanted to publish things he could have done so.

869. But he never did.

(*Sir Mark Richmond*) He never did.

(*Dr Buttle*) The Director General, according to the White Paper, has the power to advise the minister to move resources between the research councils.

870. To ask the minister to move?

(*Dr Buttle*) To advise the minister to move resources between research councils which is power enough, I would have thought.

871. Yes, it is if you know that is what he has done.

(*Dr Buttle*) Yes.

872. But if you do not know that is what he has done there is no power at all really. That is why the public aspect of it I think matters.

(*Professor Newby*) It is power as opposed to influence.

873. Yes.

(*Professor Newby*) At the moment it is set up as a brokerage position, not one that has any power but an important brokering role.

874. I am disturbed because even if William Waldegrave decided to play it that way, which he might, another minister might not. We have seen attitudes towards publication in the past change backwards and forwards several times.

(*Sir Mark Richmond*) You have only got to dissociate the Minister for Science from the Minister for Open Government and you actually remove the important control.

875. Do you think that the Director General's post will in any way affect the relationships with the Chief Scientific Adviser which have always been informal really? Will the presence of a Director General formalise that in some way, so in some undesirable way, that you cannot approach the Chief Scientific Adviser except through him or something of that kind, and likewise your relationship with the minister whom you have always been able to see in the past?

(*Professor Newby*) There is a potential to confuse. On the one hand someone might ask somewhat rhetorically, "What is the Chief Scientific Adviser for if not to advise on the science aspect, and if it is not to advise on the science and that is the Director General's job then what is the nature of the Chief Scientific Adviser's post with regard to internal OST matters?"

876. It is not confined.

(*Professor Newby*) No, it is not, I am being deliberately a little bit disingenuous in asking the question in a rhetorical way. If the Chief Scientific Adviser is there to advise on science then what is the role of the DGRC, it can only be surely some kind of management role and we come back to the problem which we have just rehearsed which is the role of the DGRC and the management role is not clear. There are lines of confusion around at the moment.

(*Sir Mark Richmond*) Let me try and put the confusion in another way. The Chief Scientific Adviser has a role advising spending departments how they will spend their money on science. He does not, as I see it, have a direct role in respect of the research councils but he is the Head of the Office of Science and Technology within which the Director General is located. It is, I think—

877. A complete muddle?

(*Sir Mark Richmond*) A complete muddle frankly. You find a failure to distinguish the advisory role from the executive role.

(*Dr Jamieson*) That is a muddle. The paradox is the Chief Scientific Adviser is also the Executive Head of the Office of Science and Technology. I read from the White Paper that the Chief Scientific Adviser is to review the whole £5 billion expenditure for S&T, of which the science budget is just 20 per cent, £1 billion, and the Director General of the Research Councils has that responsibility in relation to the £1 billion. The Chief Scientific Adviser is Head of the Office.

(*Sir Mark Richmond*) People in other spending departments are saying how can one person occupy an advisory ring-holding role in relation to our spending and at the same time be responsible himself in an executive role for spend on science in OST?

(*Dr Buttle*) I think, if I may, that is the nub of it. If we were being more positive rather than highlighting the negative aspects of this one could say the presence of the DGRC could help that arrangement in the sense that the Chief Scientific Adviser could be an honest broker in looking right the way across Government and not seen to be representing the research councils' interest in that respect but can stand back and say: "Look this is silly, the research councils are able to do this, why are you, Department of X, doing this as well?" That would be very helpful. I think apart from this nice point about the CSA

[Chairman *contd.*]

being Head of the Office it would be a positive role for the DGRC to play.

878. We must talk about the future industrial influence upon the science base. There are a number of aspects to it, one is the influence of industrial chairmen and members on research councils, which is at least a new rule, if it is going to be operated like a rule. The other thing is the influence of the Technology Foresight Programme especially if it is not balanced by "Science Foresight" disconnected from wealth creation but perhaps asking about progress of science and so on. How do you see the new bit of your mission statements about wealth creation being influenced in practice by all these various forces? In a way NERC and AFRC have had problems a bit like this already, have they not?

(*Dr Jamieson*) Not all problems, my Lord Chairman, some solutions!

879. Not all problems.

(*Dr Jamieson*) I sit two yards from a former part-time industrial chairman of the AFRC (the Earl of Selbourne) so we are very comfortable with that influence.

(*Dr Buttle*) We have gone through starting with a part-time chairman and a chief-executive, although we did not use those terms in those days. We then went to a chairman-cum-chief executive and now we are once more to have a part-time chairman and chief executive. Our new part-time Chairman, Mr Bob Malpas, has recently been appointed. As a Council I believe we see that in a positive frame of mind, in the sense that we believe that there is much to be done in finding the mechanisms for this dialogue with industry, and as you said earlier both of us making efforts on that. It is not just a one-sided effort, both sides have to make an effort. My own reaction in just the two weeks that Mr Malpus has been our part-time Chairman is that I believe he can play a positive role in that process, he can open industrial doors to help us.

Chairman] My experience of the MRC, which is not represented here today, has been that their greatest basic scientific advances have taken place while there has been a chairman and not a secretary, a chairman from outside, from industry or wherever, and it has not in any way deterred them or taken them away from their chief function of what is broadly basic medical research. I personally am not very worried about that. I am more worried by the statement in the White Paper which seems to indicate it is the scientists who have got to move their attitudes and possibly what they are engaged in rather than industry trying to take advantage of the science that has already been done.

Earl of Selborne

880. One of the imponderables at the moment appears to be the nature of the expert panels and their briefs which are there to serve as the Technology Foresight Programme. A lot will depend, will it not, on the mix of both the industry and the sciences which these expert panels are to serve. I do not know whether the research councils have some confidence that these panels will reflect your own requirements and also whether they will reflect the requirements of the Director General of the Research Councils who has to use this as a tool?

(*Sir Mark Richmond*) Howard is on the steering committee. We had the greatest difficulty in getting into discussion at all on the Foresight exercise. David Phillips got us into the discussion group but initially we were to be excluded, as indeed we were excluded from ACOST. The heads of the research councils never saw the agenda or the minutes of ACOST. I feel that the Foresight Exercise got off to a totally wrong start really. It was the old technology push. It was focused very short-term. The steering committee has in general been set up to reflect technology push. There has not been a u-turn but there has now been jolly nearly a ninety degree turn in the way in which the Foresight story is being evolved. Now, instead of announcing key technology areas which were to be considered there is now a disposition to discuss what the industry, the consumer, might need.

Chairman

881. You will remember, will you not, this is an official occasion and notes are being taken. Having said that, who is actually leading the Technology Foresight Programme in the wrong direction? There is always a person at the end of the day.

(*Sir Mark Richmond*) The Chief Science Adviser seems to have taken it on as his responsibility.

(*Professor Newby*) Both Dai Rees and I are members of the steering group. There have been two meetings of the steering group and they have been somewhat acrimonious meetings, not within the group, the group itself is drawn from a very wide range of people from industry, the academic world, practising scientists within the academic world as well as the vice chancellors. It is amazingly consensual on matters to be done but there have been difficulties, I think, in attempting to commit OST officials about the way in which Foresight should move forward. Briefly the problem is this: one version of Foresight which was presented to us in an original project plan which the group unanimously rejected was to provide us with a list of generic technologies and to arrive at a rank ordering of these. When the group expressed some surprise and dismay at this, we then suggested that not only was there an issue of market pull but starting with a list of technologies was pre-judging the solution and not exploring the problem.

882. I thought we were trying to find a vision of the future.

(*Professor Newby*) Indeed. Surely was it not the purpose of the exercise to bring stake holders in wealth creation together—industry, academia and Government—so that they may not only explore the opportunities arising from the science base but also explore the needs of the market place? There was right at the beginning confusion about these two sets of objectives, they were never set out in any document, you can look for yourselves. A number of us insisted that the purposes should be made absolutely clear at the beginning not only because confusion would prevail otherwise but also because the way in which you do Foresight depends crucially upon what the objectives are. There is no point, quite honestly, engaging in a massive Delphi exercise if at

[Chairman *contd.*]

the end of the day all you have got to do is rank-order generic technologies. If, on the other hand, it was a process of networking together in a more effective way industry, academia and Government as stake holders in wealth creation then we would adopt a very different methodology. Indeed one would not have to do it all simultaneously, one could have a rolling programme. It comes back to the issue of panels. Initially the proposal was to select panels around what one might call technology areas. I think the Foresight Group has successfully persuaded the OST to move away from that and to organise the panels around what one broadly might call quasi-industrial sectors such as energy, transport, retail services, domestic, security, things of that kind, and work out to both the technologies and the markets from there. Having said all that, one of the other issues which has dismayed some members of the steering group is that while these things appear to have been agreed in group meetings subsequent follow-up action within OST has somewhat disappointed us so there has been a need to return to these at subsequent Foresight group meetings.

883. What you seem to be saying really is that the user departments, no doubt especially the DTI, are calling the tune by shoving in the things that they would like to see done by somebody else?

(*Professor Newby*) I do not think it is that really. One version of the Foresight process is to use it to inform the PES round so in negotiations with the Treasury over the sum of the budget one could provide a robust basis for priorities. That would be the OST's original conception. The group is saying, and it is the industrial members of the Group not DTI, although DTI have a role, they are saying no, the basic purpose of Foresight should not be to inform the PES process, that will turn industry off. The basic purpose of Foresight is to enable British industry generally, not just manufacturing, to be better informed about what the science base has to offer.

Lord Porter of Luddenham

884. I wonder if Professor Newby is saying that the process is what matters not the outcome?

(*Professor Newby*) Yes, that is the view of the steering group.

Earl of Selborne

885. If you believe, as I happen to believe, I am not sure that all of my colleagues entirely agree, that industry has a valid and probably a reasonable track record in trying to identify priorities in the science base, industry will always relate to these quasi-industrial sectors that Professor Newby has referred to. I suspect that it is relatively easy for scientists to relate to that as well as to the technology. I can see that if the purpose of these panels is to bring together, and I am sure it should be, industry and academia and Government it would be very much more satisfactory, would it not, to have a base or a format with which industry is content? If they cannot relate to it then I suspect you will have problems.

(*Professor Newby*) That is the key issue, if I may say so. It depends where you define the problems as lying. This is now a personal view: my personal view is to say the problem does not lie at the basic science end in the sense that there is more than enough science and technology around to improve the industrial competitiveness of the United Kingdom. The problem seems to lie, and I think it does lie, the Council has funded work which shows that it does lie, much more at the industrial end in terms of the take-up of what is available. I think, therefore, what follows from that issue is that the Foresight activity must start from and end with the ground on which industry feels comfortable and can relate to because that is where the problem lies. If you do not get industry engaged in this process it is almost a waste of time.

Lord Porter of Luddenham

886. But the outcome will be decided eventually, surely, by industry itself. You cannot tell industry that this is the thing to come for.

(*Sir Mark Richmond*) We come back to this issue that it is being used, or seems to be being used, to inform the public expenditure round.

Chairman

887. Can we deal with that just for one moment. I think we have to accept that Bill Stewart as Chief Scientific Adviser, who has an input into the Treasury about the science budgets, does have a problem. No doubt he is trying to anticipate the outcome of an exercise like this to say that we probably need more money there and perhaps less there, that is perfectly honourable and valid, is it not? Your complaint really is that by tying this to the Foresight Programme he is more or less forcing the Foresight Programme to be too short in its outlook?

(*Sir Mark Richmond*) Yes, and he has the Council for Science and Technology which is conceivably briefing him on the issues.

(*Professor Newby*) Bill's problem is our problem, we are not complaining about that. The issue is confusion of objectives and the second order of muddle which is the belief that you can actually achieve both those objectives at once. You cannot. You have to decide one or the other as far as the Foresight Programme is concerned. Either it is directed towards prioritising PES bids or it is a process of networking: you cannot use one to achieve the other.

Earl of Selborne

888. Sir Mark has told us you were not greatly consulted in the early stages. Has the OST taken the view do you think of industry?

(*Professor Newby*) I think the CBI has made its views very well known to OST and in fairness to OST officials I have to say they have moved very considerably from their original conception. It is now interesting to see whether that is going to be followed through.

889. So the battle is won?

(*Professor Newby*) I do not think it is won but I think it is going in the right direction.

(*Sir Mark Richmond*) A ninety degree turn.

[Earl of Selborne *contd.*]

890. Have you got a hidden list, or an open list, on which you would like to see the OST panel based?

(*Professor Newby*) Yes. At the last meeting it was agreed that a small group of us would be established, and I am one of the three, and would produce a list and that has been done and is being circulated around the other members of the group. We were also, and I was personally, asked to draft objectives to be put into future Foresight documents. That has also been done and will no doubt, again—

Chairman

891. I think we would like to have sight of that as soon as it is available.

(*Professor Newby*) Adrian Whittaker, the official at the OST, could provide you with that.

Lord Porter of Luddenham

892. Without in any way revealing, of course, could you give us an example that is not on the list?

(*Professor Newby*) I am quite happy to say the list is broadly along the lines I have just indicated, it is a list of quasi-industrial sectors, it is not just technologies or disciplines, nor indeed of markets.

893. I am feeling for the breadth of one of these items.

(*Professor Newby*) Let me take one. One of the interesting things is these categories may well evolve over time and they should be allowed to do so, but let me just take one which is on the list at the moment which is leisure as a sector.

894. Enormously broad.

(*Professor Newby*) One can see once through the pre-Foresight discussions that might well be split up into tourism, music and entertainment or whatever, but at the moment it is there as a rather generic group called simply "leisure". Similarly there is a lot of discussion over the services, at the moment they are divided into retail and financial services as a starting point. These are not agreed, they are at the moment current proposals.

Lord Porter of Luddenham] These are somewhat along the lines of the old ACOST discussions.

Earl of Selborne

895. Those things seem to be very clearly industry based. Would, for example, environment be an issue that transcends industry?

(*Professor Newby*) Yes, environmental monitoring is one and health is another one.

(*Sir Mark Richmond*) Preventive medicine, that sort of thing.

(*Professor Newby*) Business processes is another one.

(*Dr Buttle*). The environment features in two dimensions in this issue, one in the sense that all technology development has to operate in the context of the environment and secondly environmental regulatory pressures which the industry will have to face, but which is an opportunity itself.

(*Sir Mark Richmond*) I think in the early days, when it was technology driven, there were areas like sensors. The dimension of social science, and indeed of preventive medicine, areas like that, were totally missing.

Chairman

896. Now that we have a clearer idea of how unclear this process is at this present time may I ask you how you see Technology Foresight when it has been developed impacting on the work of the research councils?

(*Professor Newby*) Speaking personally I think it will be very useful in informing our strategic priorities, in influencing our decisions over strategic investments, whether to put more investment into one area and less perhaps into another.

897. I think the thing that worries one if one looks at this from the extreme of let us say a small grant applicant from a small university is that if you make an application in a field that is declared to be a good one by Technology Foresight, but nobody works in it or is interested in it very much, you have got lots of money coming down and second rate research will be done.

(*Professor Newby*) That is why I say it is the levels of strategic priorities. I do not think my own Council would use the outcome of the Foresight activity to alter the assessments of quality that we use for individual grant applications.

898. You would say that was overriding in deciding where the money actually went?

(*Professor Newby*) In the ESRC's view, yes.

899. Rather than notional allocations?

(*Professor Newby*) Yes.

(*Dr Jamieson*) If I may say, Lord Chairman, although the term Technology Foresight may be novel, the principles are not really new to the research councils. For 20 years or more we have been looking ahead and trying to identify where science is going. AFRC over the last ten years has been identifying strategic level areas of opportunity, setting up co-ordinated programmes and then inviting the community to respond with grant applications to those co-ordinated programmes. We would welcome the Technology Foresight as another input into the strategic prioritising of our work, the allocation of resources, but at the individual project level scientific quality will still be the overriding criterion.

Earl of Selborne

900. I wonder specifically what use within the research council context you would expect the Director General of the Research Councils to make of this exercise? Do you see it as his fundamental brief or do you see it as an additional aid to determining priorities?

(*Professor Newby*) Personally I would see it as the latter. It is another piece of valuable information he may employ when making very difficult decisions on priorities.

Chairman

901. Do you see it as a tool whereby the operating departments of Government can get their hands on you?

[Chairman *contd.*]

(*Professor Newby*) There is a kind of what I call "tablets of stone approach" to Foresight which we on the group were rather worried that OST were intending to deploy, which we resisted. One scenario was that Foresight produces an annual prioritised list of technologies which are then handed down through the Council of Science and Technology, to the DGRC, to the research councils to "implement". I think there is not one single person on the steering group who would regard that as a valid approach to Foresight, not one, but I think there are elements elsewhere who might be tempted by this.

Lord Porter of Luddenham

902. We are concerned with priorities for the science base and I wonder should we take seriously the Chairman's phrase which he used of a "Science Foresight Programme"? If it is possible for technology to distinguish between the importance of leisure, the environment and so on, surely for the research councils it is almost easier to have a Science Foresight Programme and distinguish between astronomy, particle physics and so forth? Should this be taken seriously?

(*Dr Buttle*) I think to some extent that is the value of having research councils, they can sense where the science is going, where quality science is going and where it is developing, they have that sense and that is the advantage of us being that close to the science in operation. We also have this knowledge of what the nation needs, putting it very broadly, and I think Technology Foresight will give us better information. The trick is to match the two.

903. Could something not be said for formalising and publicising your experience and thoughts on science priorities through a Science Foresight Programme in the same way? If one is possible the other is possible.

(*Dr Buttle*) We have not articulated it in that fashion but in the NERC we have just initiated a programme on the land/ocean interaction boundary. There is no doubt about it, Government and the nation has needed that multi-disciplinary science for a long time now but the science has not been ready, we have not been able in our area to put a large enough effort together in a meaningful way and now we have. We have not said: "This is our Science Foresight Programme", we have not identified it.

Chairman

904. In the past there have always been irregular reviews of subject matter, chemistry, physics or whatever. The Americans have done it very much more massively, as is their wont, than we have ever done it but we have done ours too. I would have thought that one could argue if there is going to be a big push towards Technological Foresight and an attempt to bring pressure to bear on what you do from that, you will have to pay a lot more attention than you have been paying in recent years to subjects elsewhere because at the end of the day it is your job to match the two.

(*Professor Newby*) I think as Dr Buttle has said we do do this but I think we have done it as far as the public gaze is concerned rather obliquely and not systematically. All councils from time to time engage in subject or discipline reviews, my own Council certainly does. We also, of course, have our corporate plans which somewhat obliquely do contain elements of what we are talking about. I think the third thing that has disappointed some of us, certainly me, about the old ABRC is that there was a mechanism in the ABRC for considering once a year what was called "scientific opportunities" and I think some of us felt that that was never given the weight or the importance that it really deserved because each council did prepare documents which were looking to the future in a very unconstrained way about where the science was going but it was not treated I think terribly seriously by the ABRC and they certainly did not publish the documents.

905. That is a very important point because the ABRC at one time had some flexibility money and it helped NERC, I remember, with their research ship.

(*Professor Newby*) That was the problem with the money, it was used from time to time for the purposes of fire fighting, if it was not ships it was something else.

906. In that case the money was used with a purpose in mind but is there not a danger doing things that way that it will be used to mop up things that have been overspent at the end of the year and not used as a launching pad for something magnificent perhaps in some years' time which has not yet been thought of, something entirely new?

(*Professor Newby*) Sometimes it was and sometimes it was not. There was a sort of half-hearted attempt at this process. I always felt it was never given the importance that it deserved.

907. What I am getting at is under the new system as we are imagining it thus far there is going to be precious little room left for flexibility of that kind, is that not right?

(*Sir Mark Richmond*) It could be.

(*Dr Jamieson*) That is one interpretation of what is indeed a prescription for a rather centralised direction of science but it does not need to be operated in that rather rigid way.

(*Sir Mark Richmond*) Putting it at the extreme, if it is driven to the extreme of what is possible within that document, the prosecution of science in Britain will pass out of the hands of the practitioner into the hands of the user.

(*Dr Buttle*) That is in its extreme.

(*Sir Mark Richmond*) That is in its extreme.

(*Dr Buttle*) But we do have within our missions responsibility still to support basic science which is some measure of softening of that extreme and also we will be separate charter bodies. Also I believe it is important for us to put in place working procedures right from the start that protect against that in the future and that means people getting together.

(*Sir Mark Richmond*) It is interesting that in the first meeting after the White Paper was published the first question the Permanent Secretary asked was: "How are we going to assure ourselves that the White Paper is delivering what it says it should deliver, what are the outward measures of success?" There were no very convincing answers.

[Chairman *contd.*]

908. The OST's push has got to be in that direction because they have the White Paper telling them.

(*Dr Buttle*) It is Government policy.

(*Sir Mark Richmond*) On the question of how far it will go, I think it may go a bit further.

909. We have not talked at all about Forward Look, does it matter from the point of view of our enquiry do you think? Is it an important weapon?

(*Sir Mark Richmond*) As I understand it, it stems from the fact that it was impossible easily to find any description of what the programme of Government spending departments in science and technology was. You could find out something about what had been done, you could find out a bit about financial allocations but it was very hard to find out in a translatable terminology what policy was. There was certainly no coherence.

910. No statement of objectives?

(*Sir Mark Richmond*) No composite corporate statement of objectives.

911. That is what I meant.

(*Sir Mark Richmond*) As I understand it, what is envisaged, and I think it will be very important indeed if it is pulled off, is that the Government will under the aegis of the Chief Science Adviser prepare each year a statement of what the policy is and what part each Government department will play. That, to my certain knowledge, in certain areas is being resisted because the Permanent Secretaries of some departments are saying: "We do not get a vote in Parliament to pursue science in the department of so and so, we get a vote of money to pursue the aims of that department" and it is not said but the next statement is: "I am the person, with my minister, who decides what we spend our money on". It is almost a question as to whether it will lead to predicated elements in the votes from Parliament?

912. Under our present system of Government it cannot, can it?

(*Sir Mark Richmond*) No.

913. Neither the Technology Foresight Programme nor the Forward Look can be binding, that is quite clear, Technology Foresight because it is essentially long-term and you cannot bind anybody to the long-term. Is it fair to say Forward Look is, if you like, the medium term implementation of the long-term Technology Foresight?

(*Sir Mark Richmond*) If things are working well.

914. Foresight gives you a vision and the Forward Look gives you the objective. Is that a fair way of putting it?

(*Sir Mark Richmond*) Yes, which is why I said that it would be several years before this bedded down, if it does, into a system which is coherent.

(*Dr Buttle*) I do not imagine that the Government Forward Look could in fact fulfil that objective because it will be, as far as the money that they are prepared to spend on the science to pursue their own policies, a reflection of the Forward Look of Government policy rather than the Foresight Programme. The interesting point will be how it matches and whether that Foresight Programme will then start to raise questions about Government policy.

915. It could be the distillation from departmental objectives and programmes of what the implications are for scientific powers.

(*Dr Buttle*) That is why I agree with you, the Foresight Programme should inform that whole process, that is why it is so important that it is long-term and the processes are so important it should have that influence if Government policy is to be in tune with that.

(*Professor Newby*) I think it could be all those things. It will certainly enable it to be open to greater scrutiny but whether it will be I very much have my doubts.

916. Can we talk about your relationships with the funding councils? I think we all here understand what they have been in the past, what I would like to ask you is do you envisage any change? There is a joint committee involving you and them.

(*Dr Buttle*) Science and Engineering Base Co-ordinating Committee.

917. Does that matter?

(*Dr Buttle*) No.

(*Sir Mark Richmond*) With the separation of OST from DES, in other words the separation from the research spend through the DFE from the research spend through the universities, if you are going to retain, maintain, a dual support system you have an integrative task to do which is made more difficult by the splitting of the two departments.

918. The fact is that there is now a formal job to do because the departments are split, whereas before the departments were one and did not do it, at least we now have a formal thing to co-ordinate it, is that an improvement?

(*Dr Buttle*) Yes.

(*Sir Mark Richmond*) It is my perception that the OST is seeing the spend of the whole science vote as being for wealth creation. The White Paper says—I cannot remember the exact paragraph—that the money spent for research through the funding councils in the universities will also be for that.

(*Dr Buttle*) And quality of life.

(*Sir Mark Richmond*) And quality of life. My perception is that the DFE are much less seized of the importance of that. If dual support is going to survive is the dual support system for wealth creation? I suppose that is the way to put the question.

919. One despairs for the poor old musician who wants to study the order in which Haydn wrote his early quartets, which is a perfectly proper thing to do. Who is going to pay for him to do that? Never mind, we will not talk about that. What about your influence on university research ratings and vice versa, for example, getting down to the nitty gritty of how you do your work? Do you see that sort of influence being strengthened?

(*Sir Mark Richmond*) What is the next research selectivity exercise going to be about? Is it going to be about quality in respect of wealth creation or quality in respect of science?

920. That is a rhetorical question I presume. It is a good one.

(*Sir Mark Richmond*) What impact will that have on the unit of assessments, and what impact will that

[Chairman *contd.*]

have on the people doing the assessments and on the funding for them?

Lord Porter of Luddenham

921. The implications are it will be far more towards wealth creation than in the past.

(*Sir Mark Richmond*) Will you have the academics on the assessment panels or will you have the industrialists? This is why it could move the whole thing into the hands of the users.

(*Dr Buttle*) To some extent research councils' award of grants is one input in the research assessment exercise. I think we have to some extent a way of avoiding that double counting. If we are influencing our selections at the margins where we cannot discriminate quality by the user requirements, then that might be sufficient an influence in terms of the research assessment exercise. I for my part could see this co-ordinating committee, its first task and its foremost task, addressing with the research councils the issue of training and post graduate support. We must work together there.

922. Do you feel that that should be associated with research in universities? I gather that Sir Mark was saying at the beginning that research will go from the universities into more institutes and this sort of thing.

(*Sir Mark Richmond*) Some.

Lord Porter of Luddenham] Are you happy about that? Are you saying: "Okay, so be it"? I know a lot of the research councils, some of them, would much prefer to have their own institutes.

Chairman

923. The real question I think is do you see the training of post-graduate students, PhDs especially, coming directly into the hands of the research councils instead of just being paid for by the research councils, setting up institutes and PhD students occupying them?

(*Dr Buttle*) Certainly NERC takes the view that institutes are not the same as universities, they are complementary to universities. The whole emphasis over the last five years has been to create community projects where both elements contribute, both have their strengths and both have their weaknesses.

924. Will you be able to stick to that?

(*Dr Buttle*) We will stick to that, why should we not? A community research project is soliciting in an area where we believe the nation's interests apply but where we believe the science strength applies. We are soliciting really in title and then allowing the proposals to come within that.

Lord Porter of Luddenham

925. Is there not some advantage to getting the best of both worlds by linking those with universities?

(*Dr Buttle*) Yes.

(*Professor Newby*) To some degree, yes. We have no plans to create our own institutes. At the moment we feel that universities are still the best place for the majority of our research to be carried out. I also say we would have no ambitions to validate PhDs. I personally take the view that the university remains the best place to validate the degree. Therefore, what we are doing is frankly to change the nature of our relationship with those universities, a relatively small number, 15 or so, which are particularly important to us because 54 per cent of the ESRC spending goes into just 12 universities. I have instituted a series of meetings with the vice chancellors of those universities so we can look together at how the social science base can be sustained in those places. That probably will be the most immediate way forward.

Chairman

926. There is a sort of sub-group of the CVCP these days.

(*Professor Newby*) Strategic alliance.

927. Do they meet with the heads of the research councils?

(*Dr Buttle*) Not on a regular basis. The strategic alliance between some universities and research councils is going to grow. We and they, together, will be looking at the long-term.

928. I said we did not want to talk then about the boundaries but do you want to talk about that?

(*Sir Mark Richmond*) I think that David Phillips chaired the Boundary Commission well. I am a bit aggravated by bits of it but then we accept them and they are not tablets of stone, I hope.

929. I actually think that there is a great disadvantage in having names which are descriptors because every time you want to change the concentration of your work you have to change the name and it is silly.

(*Sir Mark Richmond*) The bit of it that worries me most is the inherent split between the physical sciences and biological sciences which lurks in the way things have been divided. At a meeting of the heads of research councils at Bagshot my French and German colleagues said they thought that setting up such a split structure was inconceivable.

(*Professor Newby*) I think I ought to put on the record my disappointment that the opportunity was not taken to include humanities in the system, particularly while there remains a split between DFE and OST.

(*Dr Jamieson*) I think the Committee will be interested to know that we are making good progress to make the new boundaries work.

930. I am sure you are.

(*Dr Jamieson*) The second point is on names, just to reassure you that the Biotechnological and Biological Sciences Research Council is a multidisciplinary research council. We envisage ourselves supporting a whole range of scientific activities in chemistry, physics, engineering, in support ultimately of the industrial users that are the beneficiaries. Part of the concern about the apparent split between physical science and biological science is the misunderstanding that these are disciplinary based research councils; they are not.

Chairman] I would have no worries about this if I believed in the power, abilities, experience and intentions of the Director General of the Research Councils but at the moment I have no reason to believe any of them.

[Chairman *contd.*]

Earl of Selborne] It is too late to change the names, they are cast in tablets of stone we understand.

931. I have a feeling the missions are not actually cast in tablets of stone at this stage?
(*Sir Mark Richmond*) No, I think that is right.

932. There could be some change.
(*Sir Mark Richmond*) It is telling that biotechnology was before biology and engineering before science.
(*Dr Buttle*) I think, my Lord Chairman, the missions are the things, not the titles of the research councils, that is very clear from the White Paper. A chemist in the lab should look to the missions as to where he goes for his grant proposal.

933. It is clear that that is the intention but a chemist—why did I speak of chemistry—a physicist ought to worry sometimes about where his subject as a whole is going. When it is split in the way that chemistry and biology will be split up there is cause for worry.
(*Dr Buttle*) Will he look to his learned society for that?

934. He may but I think you as the funders, you will have to do something about that. Maybe subject reviews at a lot more regular formal sessions might be an answer.
(*Dr Buttle*) The societies have a role to play.
Chairman] Thank you very much. I am sorry, while welcoming the informality of our proceedings, it has given the shorthand writer a hell of a time. Thank you.

Printed in the United Kingdom by HMSO
19585 C5 11/93 131876

WEDNESDAY 27 OCTOBER 1993

Present:

Butterworth, L.	Perry of Southwark, B.
Chorley, L.	Porter of Luddenham, L.
Dainton, L.	Selborne, E.
Flowers, L. (Chairman)	

Memorandum by the Wellcome Trust

(1) *Summary*

This paper describes the Wellcome Trust, the way in which the Trust sets priorities in research, and identifies and supports neglected areas (sections 3, 4 and 4 below).

The Trust's view on the White Paper "Realising our Potential" concentrates on the importance of training and career development of research workers; examines the difficulties in translating biomedical research to the needs of industry and other users; and particularly emphasises the importance of the dual funding system (section 6). Other points addressed in detail are research and development within the National Health Service (section 7), the pressures created in the research community by the drive for greater accountability (section 8) and potential problems of the shortage of scientific manpower (section 9).

(2) *What is the Wellcome Trust?*

The Wellcome Trust was founded in 1936 under the Will of Sir Henry Wellcome. The Trust derives its income from its investments which comprise broadly based international portfolios together with a continuing holding in Wellcome plc. The Trust has grown rapidly in recent years, and it is anticipated that the Trust will have more than £200 million available for support of research next year.

The objectives of the Trust are to support research in the biomedical sciences and in the history of medicine. The Trust aims to support and maintain the strength of biomedical research by providing individual researchers of the highest quality with the resources they need to pursue their subject.

(3) *How the Trust sets priorities*

The Will of Sir Henry Wellcome lays out what the Trust may fund but gives no guidance as to how, where, and to whom the Trust should provide its support. Within the general framework of the Will, the Governors of the Trust decide on policies through a continuous and wide-ranging process of consultation with the scientific community. The seven members of the Board of Governors are distinguished in the fields of medicine, science and business and the five scientific members are selected to reflect the width of the Trust's funding remit, all being outstanding university scientists. The Governors are advised by a large number of people. In the last complete funding year, 2,481 scientists, one in five of whom were drawn from outside the UK, were involved in the refereeing process. Decisions on grants were made by panels comprising 92 working scientists drawn from academic establishments throughout the United Kingdom, the Republic of Ireland and overseas. Policies are implemented with the help of full-time professional staff, many having considerable research experience, and most maintaining some academic work outside the Trust.

For the past eight years, the Trust has been in the fortunate position of having an income that has increased much more rapidly than inflation. Thus, over this period, it has not been under the same degree of pressure as other bodies to set priorities. However, clear priorities will be required in the future. At present, there are some restrictions on who may receive a grant, and some on the subjects that are funded.

(4)(a) *Restrictions on who may apply*

The Trust accepts applications for support from the staff of universities, medical schools and allied institutions in the United Kingdom and the Republic of Ireland. It does not accept applications from scientists whose salaries are paid by Research Councils or other government bodies, nor from scientists supported by the cancer charities. Scientists in other countries cannot normally apply, although there is an extensive international programme for collaborative grants and travelling fellowships, as well as a programme for support of research in tropical medicine.

These decisions are matters of policy; the Will of Sir Henry Wellcome allows the Trust to support scientific research in any country and in any fashion, for example, by setting up free-standing laboratories outside the university system.

(b) *Subject restriction and selection*

The Trust funds all aspects of biomedical research including veterinary medicine, the sciences basic to these fields and their history, with few exceptions:—

- The Trust does not support cancer research, because of the existence of other substantial sources of funding.
- Applications for research on AIDS are normally not accepted, other than one of the Trust's various competitive scholarship and fellowship schemes.
- The Trust does not at present fund research into medicinal aspects of plants, although this area is permitted under the Will.

The Trust has a long-standing policy of selecting subjects for special development. At present these include Clinical Epidemiology, Vision Research, Mental Health, Health Services Research, Toxicology, Taxonomy and Biomathematics. These subjects are developed by the provision of earmarked training awards. The Trust has particular interests in Tropical and Veterinary Medicine, Mental Health and Epidemiology, and more recently has developed a special interest in Genetics.

The Trust puts much emphasis on responsive-mode funding: last year 43 per cent of the total science spend went to the support of project grants. Close attention is paid to this demand as it reflects the changing emphasis of science. The changing nature of science is also demonstrated by the topics put forward for funding by applicants for the Trust's various competitive schemes for studentships and fellowships. Through this means, the scientific community guides the Trust's funding policies. The Trust's scientific staff remain in close contact with grant applicants and grant holders, and are alert to changes in both the subject matter and type of funding that are required.

(5) *How does the Trust discover neglected areas?*

The process of responsive-mode funding acts as a guide to neglected areas and highlights developing problems. For example, in the early 1980s, well before the problem became universally known, the Trust became aware of shortages of post-doctoral scientists of appropriate calibre, because posts awarded on project grants could not be filled. This led to the Trust increasing the stipends paid to PhD students supported by the Trust, and to its policy of enhancing salaries for post-doctoral research assistants. Some fifteen years ago, the Trust was told by the scientific community that there was a shortage of research workers with expertise in the developing problems of infectious disease. Special training fellowships were provided, and holders of these fellowships were later able to use their expertise on the new problems posed by the emergence of the AIDS epidemic. The shortage of scientists with up-to-date skills in taxonomy became evident through the Trust's interest in tropical medicine, and led to a special initiative in this area announced at the time of the House of Lords' recommendation. At present we are aware of the shortage of expertise in protein crystallography, and the Trust is keeping this problem under review in case special measures are needed to remedy it.

Large units funded by the Trust during its period of growth in the last decade reflect in part long-standing interests, such as in mental health and tropical medicine, and in part current growth areas of science such as genetics, epidemiology and neurobiology. Two of these larger enterprises are funded in partnership with other bodies: the Institute of Cancer and Developmental Biology in Cambridge is funded jointly with the Cancer Research Campaign; and the Sanger Centre, for studies on the human and other model genomes, with the Medical Research Council.

(6) *"Realising our potential" (Cm 2250, 1993): the Science and Technology White Paper*

The Trust welcomes the decision of this Government to recognise the importance of scientific research, by ensuring that science has a specific voice at Cabinet level, and by the creation of the Office of Science and Technology. The Trust also welcomes the emphasis on science evidenced by publication of this White Paper. However, this increase in the profile of science at Government level has come about at a time of severe national financial difficulty, which will make it very difficult to implement new policies.

Biomedical Research depends greatly on the availability of a trained and committed workforce: 60 per cent of the Trust's funds go to provide salaries for research workers. The White Paper acknowledges the importance of proper training for research, but the Trust believes that many of the real problems underlying the flight from science and technology are not seriously addressed.

For more than a decade, the pressures on the scientific workforce to increase productivity have been ever increasing. This pressure has come from two directions. Government has changed its funding of universities and Research Councils to increase productivity and accountability: and in addition the pace of competition in scientific research both nationally and internationally is accelerating rapidly. However, there is evidence to show that salaries of UK scientists have declined by about 30 per cent in relation to other comparable professional groups over the past decade. At the same time, career stability has been undermined, and established posts have been lost and replaced by short-term contracts. Thus, much increased productivity by the scientific workforce has been rewarded by a real decline in their financial rewards and career satisfaction.

The apparent failure of the Government to recognise the consequences of these policies to a profession which is internationally mobile is extraordinary, particularly for a Government so dedicated to the need to respond to market forces. The best scientists are particularly prone to be recruited to more attractive positions abroad, and simple quantitative assessments of the flow of scientists in and out of the UK do not adequately describe the quality of those who are lost. The Trust is particularly well placed to observe the international market in scientific manpower, through its extensive international fellowship programme.

The Trust recognises this problem and has taken various steps to increase the stipends of those it supports. It is presently revising its schemes of support to provide career support for key individual basic biomedical scientists. Such career funding for clinical scientists has been in place for some time, with demonstrable success. The Trust wishes to emphasise its belief that improvements in salaries and career prospects, combined with more sensitive management, are crucially important to restore the morale of the scientific community.

The White Paper recognises the waste of talent through the loss of women to research in science. However, no practical measures are proposed. The Trust agrees with the concern about the lack of women in scientific research, and provides practical help in a number of ways. It is also involved with the working group set up following the publication of the White Paper to consider the issues relating to women in science.

The White Paper emphasises wealth creation through the transfer of the fruits of research, and requires that the research councils put equal emphasis on basic research and on meeting the needs of users of research. In biomedical research, "users" include providers of health care as well as the biotechnology and other industries. For this dual mission to succeed, the research councils and indeed Government will depend on the goodwill of scientists to support this explicit instruction. Users, once identified, will need to display equal enthusiasm.

The Trust believes strongly that scientists are anxious to see the fruits of their research translated into useful products, and this is happening at an accelerating rate in biomedical research. However, rewriting the mission statements of Research Councils and insisting that the most senior posts are given to industrialists is not a message likely to make scientists perform with increased enthusiasm. Once again, the Government has given a message that scientists should be on tap and not on top.

In the Trust's experience, scientists have a clear view that the problems of translating research into industrial development lie more in company boardrooms than in the scientific community. The Trust would urge the Office of Science and Technology to explore more deeply where the fault lies. The Office of Science and Technology might consider proposals that there be a link between the amount of research and development expenditure by a company and the level of corporation tax that they are required to pay. This is an effective and well known mechanism used in other countries, such as the United States of America.

It may be in the mind of Government that all scientists should become expert in protecting intellectual property rights, and in technology transfer. If so, this is a matter of real concern. In the Trust's view, scientists are already fully occupied with their existing tasks. The cost of protecting intellectual property is considerable and special expertise is needed, in addition to expertise in transferring technology into industry. The White Paper is silent on these important points. The implication is that funds for these purposes will probably have to be found from existing Research Council and university budgets at the expense of funds available for research itself.

The Trust welcomes the White Paper statement that the dual-funding mechanism will be maintained. However, it is of particular concern to the Trust that the disposition of funds for research through the Funding Councils remains opaque. A clear statement of the relationship between university research grant income and Funding Council grant would be widely welcomed. The transfer of funds from HEFCs to the Research Councils has damaged the financial position of most of the institutions that represent major strengths of UK research, at least in the short-term. This has resulted in increased pressure on the Trust to provide funds for basic costs previously provided by universities from their Funding Council grant. The Trust will continue strongly to resist these requests. In the Trust's view, it is inappropriate for a charity to meet the essential core costs of university departments, a part of the science base that firmly lies in the responsibility of Government. The Trust would welcome a clear statement of the continued maintenance of the dual-funding mechanism. Universities should recognise that the part of their Funding Council grant that relates to charitable support for research should be used to underpin that research, and the Trust would also welcome a clear statement from the Funding Councils of their commitment to provide this support.

The White Paper makes public awareness of science a priority, and the Trust is active in this area through the Wellcome Centre for Medical Science. The results of this summer's public examinations emphasise that schools are a priority target for the improvement of awareness of science, and of the image of science as a career. The Trust regards the Office of Science and Technology's budget for public awareness as being quite inadequate.

(7) *The Department of Health's Research and Development Initiative*

The Trust welcomes this initiative, which is led by Professor Michael Peckham. There is evidence that it has proved valuable in promoting a research culture within the Health Service. The way in which Professor Peckham and his team have incorporated a wide constituency from within the Health Service into the initiative has been particularly successful. However, much of the activity has been concerned with finding out about research that is already underway. There is a need for much new and important work in this area and there is no prospect of success without real evidence of adequate research funding. In the Trust's view, it would be inappropriate for research of direct concern to the providers of health care to fail because of the lack of funding from the Department of Health and Health Authorities. There is a need for reallocation of financial resources within the Department of Health, or the initiative will fail.

Research within the Health Service is underpinned by the Service Increment for Teaching and Research (SIFTR). At present, this funding provides essential infrastructure support for research funded by the medical research charities and the MRC and it is essential that it is not diverted for direct funding of research projects through the Regional Research Management. The Association of Medical Research Charities has recently produced evidence that the distribution of SIFTR between regional health authorities has not corresponded appropriately to the distribution of research funds from AMRC charities. We understand that the distribution of SIFTR is being reviewed. There would be merit in separating the distribution of funds for the service costs of teaching and the distribution of funds for the service costs required to underpin research. Research workers in regions inadequately provided with SIFTR have particular difficulty in being confident of the basic clinical resources necessary for their research work.

A further problem in research directly relating to the Health Service is the lack of suitably trained research workers. The Trust plays some part in dealing with this problem, by supporting training fellowships in Health Services Research and in Epidemiology, and a limited scheme of Health Services Research Project Grants. More training fellowships in Health Services Research are needed, and the Health Service must plays its own part in creating trained manpower. It will be some years before appropriately trained manpower is in place in adequate numbers for a really effective NHS R & D programme.

(8) *Accountability*

The Government is rightly preoccupied with accountability, but has not taken adequate account of the human and other costs necessary to make biomedical research more accountable. The transfer of funds from the HEFCs to the Research Councils assigned more of the overall science budget to individual and relatively short-term grants, to the detriment rather than the enhancement of accountability for research funds.

The drive for accountability and assessment of research output has also placed extra pressure on university departments to obtain the best possible ratings in each research assessment exercise. This has caused an increasing demand for research grants, as academic staff endeavour to increase the quantity and quality of their departmental research effort. A consequence is the reduction in the overall quality of research grant proposals received by the Trust, and an increase in requests for short-term research assistant posts—thus exacerbating the career development problems highlighted in the White Paper.

Furthermore, the stress on accountability and the transfer of responsibility for this to individual scientists, has removed from many universities their ability to develop and improve the infrastructure and core facilities for scientific research. For example, refurbishment of research accommodation may be essential, but very difficult to justify by short-term outcome. The Wellcome Trust does not, and does not need to, place so heavy an emphasis on accountability, preferring to strike a balance between on the one hand ensuring within reason that its funds are being spent in accordance with the aims of the research, and on the other immobilising the grant recipient in unnecessary paperwork. The Trust has received many complaints about the burden of paperwork now placed on senior scientists in the name of accountability, sometimes effectively minimising the time available to them actually to do research.

(9) *Future staffing of schools, universities and medical schools*

The Trust has noted that in the next decade many senior posts in universities will become vacant through retirement. It is also widely recognised that the quality of science teaching in schools needs to increase. Will there be sufficient people of the appropriate calibre to fill these vacancies?

Unless serious steps are taken to improve the attractiveness of careers for scientists in the United Kingdom, whether as school teachers, university staff, or research workers in the academic world or industry, it is likely that there will be a serious shortage of adequate scientific manpower. The Trust considers that the most important problem facing the science base is the serious deficiency of scientific manpower of the right quality for the future.

Examination of witnesses

DR BRIDGET OGILVIE, Director, and PROFESSOR SIR STANLEY PEART, Deputy Chairman, the Wellcome Trust, were called in and examined.

Chairman

935. Thank you, Dr Ogilvie and Sir Stanley, for coming to see us today. I think seeing one of the major private charities is a very important thing for us today when we are investigating, as it were, the behaviour of the state and its agencies. It would be nice to have an independent view on what they do. I thought it would be useful if you were to start off by saying how you take the White Paper, whether you think it is useful, whether it helps you in your work, whether you think it is good for the nation, so to speak, as well. May I leave it to the two of you to decide who says what?

(*Dr Ogilvie*) Yes. My Lord Chairman, we are delighted to see that the Government is taking science so seriously and this is manifest by the White Paper, so everything we say can be taken in that light. It is tremendous to see science put up-front in this way and the White Paper is a very well written document. Its theme is creating more wealth, which nobody could possibly quarrel with, and nobody in the Wellcome Trust particularly could possibly argue with the importance of that. We are a little concerned as to whether or not industry will participate in the way it is suggested, at least by inference, in the White Paper because industry is on top (as Chairmen of the Research Councils) and we would say that the scientists once again are on tap. That might be appropriate, but speaking for the basic scientists, you may not hear what they really think, because they will be intimidated perhaps from saying it. I think there is a good deal of anger in the scientific community, particularly the biomedical community, with this emphasis in the White Paper considering the tremendous effort they have put in over the last decade or more when their salaries have been relatively diminishing and their career structure has been deteriorating. They have performed, all the evidence shows, as well as their peers in other countries and they feel that industry has not performed in parallel with them, so I hope very much that the main consequence of the White Paper will be that industry will be truly encouraged to notice the enormous strength of the excellent biomedical science in this country, with major input from the private sector, and capitalize on it to the benefit of the nation. Sir Stanley would like to talk about the more medical side of the White Paper.

936. Do you think that research quality has been maintained over the last few years? Answer by all means only for your own camp, if you wish, but you must have a general impression about research quality as well. Are you able to say something about that?

(*Dr Ogilvie*) I think because in the biomedical sector the money has been going up considerably, largely because the charities, not just the Wellcome Trust, have been growing, we have probably been able to retain a significant number of the really bright people and increasingly, as the Wellcome Trust has grown, we have been able to attract back some of the stars who undoubtedly did go overseas, and in our current activities we are seeing more and more evidence that some of these extremely bright people who are abroad are coming back. In other words, we think the standard in quality terms is being maintained and perhaps increased in biomedical science.

Lord Dainton

937. I do not want to put words into your mouth but when I read the document on the Trust I got the feeling that when you were referring to the fact that industrialists really are leading this, you felt profoundly sceptical that the remedy which was proposed for creating wealth, which is a major aim expressed in the White Paper, was the right one. In a sense you were saying it is the transfer of the technology not the basic science which is wrong and, therefore, it is wrong to try and prioritise basic science on the grounds of this possibility of creating wealth. Is that right?

(*Dr Ogilvie*) I think you put it much better than I could put it myself. I totally agree with you that it seems to be the wrong way round.

938. So you think we have got out of balance in that sense in biomedical science? Would you not say this is true for the physical sciences?

(*Dr Ogilvie*) I cannot speak for the physical sciences.

(*Prof Sir Stanley Peart*) I think actually it is the wrong way round, very strongly. If you think of some of the discoveries which have been made which are really important to the biomedical world, it is some of the lost opportunities. If you take imaging techniques, which depend upon physical principles, of course, in which we led the world, starting with CAT scanning and now with magnetic resonance—it is the take-up in this country which has been lacking. We lost a lot of opportunities. The science was largely first-class obviously, and yet it was not taken up. If you look at biomedical science in a different aspect, obviously the pharmaceutical industry has played a big part here. The amount of money which comes from the pharmaceutical industry into academic clinical medicine, is very large. It is not actually well quantified either and it has been coming in for many years. I actually think there is a fundamental problem revealed here for industry which I think we will come back to in subsequent comments about other questions. It is really the structure in which we are operating. The main problem for biomedical research in this country, which is shown by what is happening in London very clearly at the moment, is the absolute paralysis of the ability to do anything seriously because of the organisation, the way in which people are hanging about waiting for decisions, for something to happen.

Chairman

939. You are talking about the clinical side?

(*Prof Sir Stanley Peart*) Absolutely, I am talking about the clinical aspects of medical research. In fact, if we take one of the major remits of the Trust, which I would say is to put together the biomedical science

[Chairman *contd.*]

and the basic science important for clinical application then I think one of our major problems is how we tackle that at the present time because there is a distinct planning blight on everything we look at and it will spread 'way beyond London in very short order.

Lord Dainton

940. That has three prongs again basically from what you tell us in your paper. One is the research councils themselves and another is, I presume, the Higher Education Funding Councils whom, by implication, you criticise in your paper, and I suppose the third is the health authorities which seem to be uncertain about their role in research because Professor Peckham's recommendations have not really worked their way through. Is that right?

(*Prof Sir Stanley Peart*) Yes, I would say that is absolutely right. If you look at it, I think from a clinical medicine application, what one sees is this: the clinical imperative leads the way, therefore hospital trusts lead the way, they must be satisfied in some way, as you know, by budget holders and so on. Education and research come very low, as I see it, in the priorities in this area. They are dragged along in a way which I think is very, very bad. I think it is a sure way to disaster because if you have hospital trusts leading without taking account of research and education which you can see happening in London at the present time, then I cannot see the recipe being any sort of success.

Chairman

941. I do not want to put words in your mouth, Sir Stanley, but do you think every medical school should have a special health authority?

(*Prof Sir Stanley Peart*) I believe that decentralisation in terms of hospital trusts as such is a good way forward because I do not believe you can impose very large structures with any hope of success and I think that has been one of the weaknesses of it. What I am saying is that unless there is a collaborative approach to all of these problems, and there is not at the moment, and if you look just at the London scene, I need hardly say this to you, what you see is that the putting together of hospital trusts is proceeding somewhat independently of education and research components. They just do not marry up. Now, if you do not approach it in a unified way, you will not have the structure on which you can build these properly.

942. And this issue vastly outweighs what the White Paper is about in the case of biomedical science in your view?

(*Prof Sir Stanley Peart*) Absolutely. I think it is the cardinal issue that is before us.

943. Unfortunately it is not the cardinal issue of this particular enquiry, interesting as it is, but it is very important that you have said that because we must look at all the other things that you say with that in the forefront of our minds. The White Paper of course tries to set out a vision for a national strategy for the science and technology base and some indication of the mechanism for seeing that vision. What do you think of that concept? Is there a national strategy for biomedical science at the present time? If there is, who sets it? Do you, or at any rate do you take a part in that or do you just stand by and do whatever takes your fancy?

(*Dr Ogilvie*) I do not think we can say that there is a formal national strategy for medical research, but the biomedical scene in the United Kingdom is small enough for all the key players to know each other and to know each other well. We are already working very closely with the Medical Research Council formally and informally, and we are working with the major charities formally and informally. If we had a formally co-ordinated top-down approach, we would not be very keen to be involved in that because we actually do feel that science has to be driven by the people who are doing it and not by committees from the top. We would really intensely dislike having to take part in such a scene and we think that the great strength certainly in biomedical research is that we have plurality of funding sources in the United Kingdom. All of us who have taken part in the peer review process know that it is the best system available but that it is by no means a perfect process. The very fact that we are now the same size roughly as the Medical Research Council means that there are genuinely two sources of funds and we feel it is very important because it is not possible to be perfect in decision making in grant applications so I think the present situation which has developed very rapidly in the last couple of years working with related funding bodies on a formal basis on specific projects and on an informal basis continually works to the benefit of science.

(*Prof Sir Stanley Peart*) I think we could give concrete examples of that. For example, the Developmental Biology Unit at Cambridge headed by John Gurdon is a good example of collaboration with the Cancer Research Campaign and that sits side by side but intermingling and working and that is a very happy arrangement for us. As you are well aware, the latest development in the human genome project at Hinxton Hall, Cambridge, that again is an example which has taken quite a lot of thrashing out as between the MRC and the Trust. There are many areas where we can collaborate. What I do think though is that the scientific community must always be able to look at numerous funding sources because we may turn down something which the MRC thinks is wonderful and so on. There must always be alternatives for funding and we should not be seen to be too cosy together, because that is not good for science either. I do actually think that there should be a national strategy only from the bottom up approach. That is, the only things I think that are a national asset are young people and young people entering science must always be able to look to a career which is fulfilling. For that reason, we have recently revised our career development award system, trying to provide, and we can only provide in certain areas and certain numbers which obviously relate to manpower problems as well, but, nevertheless, we are trying to ensure continuity. I believe that is the main function of a national strategy.

944. But the Technology Foresight Programme is a bottom up strategy, if you like, and if you translate

[Chairman *contd.*]

the word "technology" in your case into "clinical activity" you can surely develop some kind of strategy from the bottom-up there, can you not?

(*Prof Sir Stanley Peart*) Yes, I think so, but at the Trust, while we take initiatives in certain research areas, at the end of it what one is dependent upon is people coming up with bright ideas. I think if one is not in a position to give them confidence in their future, then I think that is the national asset which we lose and, as you will all know, scientific morale is subject to various winds of change and it is easily damaged. I actually believe that scientific morale has been damaged at the moment because of the sort of indecisiveness that is going on.

Lord Dainton

945. On that point, my Lord Chairman, there seems to be an inconsistency which I would be glad if our witnesses could explain because in the paper you are quite specifically saying that the quality of the applications which come before the Trust has gone down in recent years and yet, on the other hand, you seem to be saying that the policy should be driven by those people who are making the applications. Now, if those two statements are put together, that is a recipe for diminishing quality of choice. Where do you think your role of intervention is and where do you think the White Paper has failed? Is it in not encouraging young people in their career development and, therefore, you think everything would be all right if there were good salaries and so on and a good provision of well-found laboratories?

(*Prof Sir Stanley Peart*) If I may start, I think there are certain areas in which I am much more competent to judge than others, and even that may be doubtful, but the areas in which I see the problem, include the bioscience clinical application interface which is a very great weakness in Britain. If you compare it with the United States, I think we are very defective in that inter-relationship. Now, if, say, on the other hand, there is a paradox, as you have said, because the applications in certain areas are going down, there are certain areas where in fact the applications are excellent and we are already running into a situation where we are, as the MRC is, turning down good applications for lack of funds. That is starting to happen. Because we are receiving many more applications the funding rate is going down in terms of percentage. Therefore, we can say that the applications could look biased towards not being so good in that sense, but only in that sense.

946. Is that simply because the workers are finding it necessary to go outside their institutions to funding councils and the research councils now? Is it a manifestation of shortage of funds elsewhere?

(*Prof Sir Stanley Peart*) Yes. If you look at some of the major areas in this country, if you balance what the university puts in, I can give an example, without naming the university, of one major enterprise which is again one of the outstanding areas of scientific application in medicine in this country, and about 85 per cent. of the funds come from outside the university, staff and everything else, so that is quite a figure.

(*Dr Ogilvie*) May I add one thing to that, my Lord Chairman. As Sir Stanley said, the perception of how good applications are is very difficult, and he pointed out that as our income has gone up so our funding rate, i.e. percentage of success of applications, has gone down, and that occurred over a time when our money was uncommitted to a very large degree. So the peer review committees felt they did not want to spend as much money as they could have on the applications before them. There could be two reasons for the huge numbers of applications we receive. One maybe the general shortage of money, the other is that there is a drive to get more and more money by each university in order for it to do well in the HEFCs' research assessment exercise. We cannot tell you which of those factors is involved in causing the deluge of applications we receive but certainly the number of applications we are having to handle now is quite appalling, so the funding rate has dropped precipitously. We simply cannot keep up with the demand despite the fact that our money has gone up so greatly.

Lord Dainton] Does not SIFTR help in providing money?

Chairman

947. There is a question mark over it now anyway, is there not?

(*Prof Sir Stanley Peart*) Yes, there is. What happens to that with the re-organisation of things is a matter—

Lord Dainton

948. You mean it gets lost?

(*Prof Sir Stanley Peart*) It will get lost.

949. That is a very serious statement to make because it is the bread and butter of the researchers together with the HEFC, is it not?

(*Prof Sir Stanley Peart*) Does it not depend on which direction it goes? That is the problem.

(*Dr Ogilvie*) As SIFTR is at present, can I illustrate by explaining the situation in one region, and I prefer to be anonymous about this, where the regional health authority has a budget of £400 million and gives the medical school associated with that region £4 million a year as SIFTR to underpin the clinical research. With trust status the medical school hospital would have a budget of £100 million. How much money will it be able to put in to the medical school in the form of the equivalent of SIFTR, i.e. what is going to happen to SIFTR as these regions get split up in the trust-making process? This is a very important issue for clinical medicine.

950. This is very worrying in one sense and again I do not want to put words into your mouth but one is sacrificing the future for the present because the quality of medical care in the future depends on the quality of the young people coming through and their research, is that right?

(*Prof Sir Stanley Peart*) Absolutely.

(*Dr Ogilvie*) We certainly endorse that, absolutely.

Baroness Perry of Southwark

951. What would you like to happen to the money? As the Trust splits the money up, you are rightly—and I share your concern—concerned that what each

[Baroness Perry of Southwark *contd.*]

individual trust is left with will be too small to do anything sensible with it. What would you like to happen to that money and how would you like it to be handled? Would you like it to go on being given *ad infinitum* where it was given before or would you like a single body within the Health Service to be responsible for medical research? How would you change the system?

(*Dr Ogilvie*) I would simply say at the moment we know there is a mismatch between the present distribution of SIFTR money and the current strength of medical research in the medical schools. That is quite obvious from the data.

952. That argues against leaving it where it is now?

(*Dr Ogilvie*) It does seem necessary that it should be re-organised.

Chairman

953. With great respect, we are not talking about the re-organisation of the National Health Service or even about SIFTR but about the priority setting of the White Paper especially, and naturally we want to talk about biomedical science with you, but may I ask you this: were you consulted as a Trust, a very important Trust in your case, about the writing of the White Paper, about points it might make, about policies it might propound? I am sure you gave evidence but were you consulted?

(*Dr Ogilvie*) We gave evidence in the form of a written submission, yes.

(*Prof Sir Stanley Peart*) But no more than that, I think.

954. Really one of the central things about the White Paper is the Technology Foresight programme, the idea that you can somehow develop the strategy bottom-up. Would you expect to be consulted about that in your own area? Has anybody suggested you should be?

(*Dr Ogilvie*) May I comment on that because, as you probably realise, we got interested in Foresight some years ago when we set up our Policy Research in Science and Medicine Unit and one of the things we started two years ago jointly with the Medical Research Council and the British Heart Foundation was a Foresight exercise in cardiovascular disease, which we chose because of its key importance in medicine. We started two years ago and the final meeting for this will be in December and it is important to note the time it takes. There were two reasons for taking this length of time: one, because although Foresight is part of the fabric of decision making in other countries, it is not in this country, and Dr Joe Anderson, who heads our Unit and is heading up this exercise found, after visiting the countries where it is already an on-going process, that it was not possible simply to transfer the methodology just like that into this country because it depends on how people work together. In some countries people are used to working in a consensus way and coming to consensus before they make moves. In other countries that does not happen, so he first had to work out a way of doing it suitable for the United Kingdom which involved consulting many people. Secondly, it take time to find the key players and get them to work together . Dr Anderson took quite a long time with the help of our files, the files of the MRC and the BHF, to identify the key players in this country in cardiovascular disease, including reference to the literature, and then by various means he looked for the young people recently coming into this field who are usually the main source of new ideas. Then when that group got together they defined what they meant by cardiovascular disease. This may seem quite obvious but it is necessarily an iterative process so that the whole process becomes "common property". From there they have had many discussions, both with the producers of research and the users, people in the National Health Service, people from industry, trying to identify what all involved consider to be the key issues. That has taken two years and the process will culminate in a workshop with everybody participating to look at various scenarios for the future. My understanding is that this exercise has been well accepted. People have been enthusiastic and concerned about it and as soon as we come to the end of the process Dr Anderson and his colleagues shall be publishing both the process that was used, how it was developed and the outcome.

955. I should have thought those who developed the Technology Foresight programme in Whitehall would have been agog to hear you say all that?

(*Dr Ogilvie*) Dr Joe Anderson has been asked to be one of the consultants for the OST foresight exercise.

Lord Dainton

956. But is there not a problem in this sense, in that Technology Foresight in your field is defined by the diseases in the sense that you want to get rid of them, but it is also true, as Professor Sir Stanley Peart has said, that in a sense the basic research is an essential element in creating the opportunities for Foresight and, therefore, there is always an unknown question in that, an element that has to be left free, which is part of the basic research because it gives powerful opportunities from time to time to shape the target? Is that fair?

(*Prof Sir Stanley Peart*) Yes, I think that is fair.

(*Dr Ogilvie*) I think one of the things we have learned from this exercise is that you cannot pre-select areas of science for Technology Foresight. You need to take much broader areas, whether it is promoting a particular industry or studying a particular disease. If you try and examine specific techologies that are already existing, it is the opposite of Foresight. You cannot specifically say, "Let us look at this technology or that." You need to try to determine what is needed in a particular area or a particular section of industry.

Lord Porter of Luddenham

957. My Lord Chairman, you are quite right in saying we are not discussing the National Health Service, and we are discussing the science base, but they are close and the one thing that Sir Stanley appeared to say, and it worried me very much, was that he said that in the hospital reorganisations and so forth research and education are given a very low priority compared with the clinical side. Well, much of medical research of course must be done in

[Lord Porter of Luddenham *contd.*]

connection with hospitals because you must have patients to do it so he is really saying that the science base as a whole is being given a lower priority. Is this so and is he worried about it and where is the research going to be done?

(*Prof Sir Stanley Peart*) I am considerably worried about it because I do not hear it being publicly discussed in the way I think it should be. You see when one says, "Right, the White Paper and Foresight is there, and it should answer the problems", I have to look at the reality of what is actually going on. It is essential obviously for the National Health Service, and sorry to keep returning to the clinical side of it, it is essential for some sort of sense to come out of the reorganisation. I am speaking from the standpoint of my experience of medical schools, and what one sees is that the first priority is, "Let's satisfy the clinical needs in a particular area". Now, there is a gross mismatch between research and the clinical needs. Although one is well aware that some of the more momentous discoveries which have altered the face of medicine have come from people who have not the slightest relation initially to clinical medicine, it is fine as long as it can be put into practice very quickly, but, and I repeat, the lack of interface there leaves us very short because if you do not take account of who is going to educate medical students, for example, and the researchers allied to them, then that has to be a grave defect. The clincial research equally is subject to a sort of mismatch where you have a hospital trust which is looking around for the budget holder to provide it with support for a particular type of clinical problem. Now, the mismatch is obvious and in some areas it is gross and can hardly ever be brought together, so when I look at the reorganisation up and down the country, I say, "Well, now, who should be looking at this as a joint effort?" It should be a joint effort because in London one has the hospital trusts which are leading, as I see it, the way; the London Implementation Group is going to report shortly, we hear. We have had the Tomlinson Report which largely has received a very favourable reception and people have already moved their positions according to the Report, but the London Implementation Group is now looking at it somewhat differently as these things come out, so it is not surprising that, for example, from the Trust's point of view we cannot actually put our money into London at the present time and we have actually stopped funding certain things which we might otherwise fund because we do not know whether the people will be in place to do it.

958. Will this diminish the medical science base of the country as a whole or will it just move somewhere else?

(*Prof Sir Stanley Peart*) Well, can it move somewhere else? Thirty per cent of the major activities are occurring in London, both in research and education and much clinical care.

Chairman

959. I think, if I may say so, you are making a very good case for us to have a look at medical research again, but I am not going to look at it today!

(*Prof Sir Stanley Peart*) Sorry, Chairman. My hobby horse is obvious.

960. Yes, and very understandable too. Now, we are trying to learn lessons from your previous experiences. You have had the Foresight programme of your own going on which will be finished soon. How do you imagine you will use it? Do you think it will have a substantial influence on the way you go about your business?

(*Dr Ogilvie*) We really think that will be the case, but it is not quite finished.

961. No, I know that and I am not trying to get you to say what is in it, or what you will do.

(*Dr Ogilvie*) We suspect that as a consequence of it we may well set up a special initiative within the Trust to deal with it, but it is still premature to know for sure what the consequence will be for our future activities.

(*Prof Sir Stanley Peart*) The history of it is that it started as an in-house process to help us decide where we were going and whether we were achieving any worthwhile objectives. I note that SEPSU, which I have always had a high regard for as an investigation, established a way forward and this method applied now to this area is very important and it will become, in my opinion, a national asset. When you say "Well, how do you know what you are doing and where are you going?" you have to have that sort of data to be able to tell you, so I think it will be something we will continue.

Lord Dainton

962. On looking ahead, my Lord Chairman, which is the question we are concerned with, and priorities, perhaps you could explain to us, if you do not engage in a sense in this kind of activity and you do not particularly believe in the notion of setting priorities from the top down, why did Wellcome abandon AIDS research? That was a top-down decision, was it not?

(*Dr Ogilvie*) May I answer on AIDS? We were in fact the first body in the country to fund research into what became known as AIDS and at the same time that AIDS first manifested itself in this country, we were funding a special programme for developing clinicians who had expertise in managing infectious disease. Soon after the AIDS epidemic hit us, the Medical Research Council was given had a special pot of money to support AIDS research. The people we trained in clinical infectious diseases became the people you see on television talking about AIDS and we found that the money that was available through the Medical Research Council was sufficient in fact to mop up all the good quality applications which were available. Our recent policy has been that we do not accept applications for AIDS, but we will take them if they have been turned down by the MRC or other bodies because the peer review process is not perfect, but in practice we receive very few applications.

963. In practice it was a sensible decision from looking at the whole field and deciding that certain areas of cancer research and all the rest of it were already adequately provided for.

(*Dr Ogilvie*) Yes.

Chairman

964. And that was a top-down decision.

(*Dr Ogilvie*) Based on availability of funds elsewhere and the performance of applications, in this case.

(*Prof Sir Stanley Peart*) We do make top-down decisions of course. Every Body like ours does make top-down decisions. It would be hypocritical to say we did not. We try to restrict them and we try and base them upon evidence coming from our contacts with the scientific community and we take note. For example, I spent the morning chairing a meeting on cardiovascular research and the ways ahead that we might be taking, because it was suggested that we had a weakness in the interposition of basic science with the clinical applications of research and that we were perhaps not doing as well in this area as we should be. As a result we are going to discuss the possibility of setting up a working party on the subject to see where the Trust might interpose itself. We have a long tradition of being capable, like the MRC, of seeing gaps and it would be foolish to deny that people with special experience should not see gaps—that is their job—and to put it to the test. There were gaps, for example, in the application of basic science in psychiatry and neurology and about twelve years ago I had the happy task of setting up what was then called a Mental Health Panel for the Trust which has now become the Neuroscience Panel and which includes psychiatry, psychology, physics and hence right across the board, because our panels are constructed to contain experts on basic science and clinical applications so that we can take initiatives, and we do, and of course that now takes up a vast amount of our funds.

(*Dr Ogilvie*) May I add to that, my Lord Chairman, that the specific initiatives we take especially when they first start represent a very small percentage of our funds. As an example, we currently have a special initiative in what is known as biodiversity, previously called taxonomy, bio mathematics, epidemiology and mental health fellowships. These "selected" areas where we are trying to train people in a particular area represent at the moment only 4 per cent. of our spend. The vast bulk of our spend is allotted according to the peer review process for bottom-up "responsive mode" applications.

965. Understood, but since we are trying to learn from you things of more general applicability, why was it you hit upon psychology, psychiatry and all that lot? Was it because there was pressure from the professions, was it because there was pressure from the Government, was it because of pressure of applications?

(*Prof Sir Stanley Peart*) Within the Trust, because of our various backgrounds as trustees (together with the experience of the scientific staff) when we discussed these matters and when we looked at the whole scene and perceived the amount of research, as judged from both the applications to the Trust, and to the MRC, for work in the area of psychiatry and any basic science relevant to it, as containing very poor applications or almost no applications, there was a problem. Our investigations revealed that there was an educational problem involving research training and we had to say, "If we are going to tackle this, how do we start?" We started off with a working party to look at the scene and we became persuaded that this was an area that was ripe for development. It has taken, as I say, 12 years to see any sort of results that we could take pride in, where you can start to see that the interposition is starting to work and that the basic science is coming into the field so you can see the revolution occurring in psychiatry and psychology, where the work done by the imaging and other basic science is transforming it, where, in fact, we should feel rather pleased with the effort.

966. Did this lead to a lot of second-rate applications to start with?

(*Prof Sir Stanley Peart*) That is where the education comes in. Let me give you a hard example of how we set about that. We felt that there had been a lack of appreciation among psychiatrists that training in research would be pointful but we found one enlightened centre to start with that would collaborate. So we provided support for an educational and research project programme. Out of that has come a group of psychiatrists who are now starting to seed out into the various centres and who are still continuing with research in collaboration. I did not think it would work at all but it is starting to work. That has taken, as I say, over ten years to see it succeed and that is now spreading because we are now supporting three other centres like that, and it is spreading to other disciplines. That is what I meant by putting the educational aspects of the research together with the clinical applications.

967. I think the ten-year timescale you have mentioned is terribly important.

(*Dr Ogilvie*) May I give another example of what we used to call taxonomy but which now it is politically correct to call "biodiversity". We got interested in that through our interest in tropical medicine and to some extent veterinary medicine when we found applications coming to us which we could not fund because the applications did not have expertise in taxonomy. We know expertise in this subject was declinging progressively. We set up a programme. In the first couple of rounds the applications for training fellowships were quite poor so we did not fund them. We then looked to see where people might be trained more specifically, and in the most recent round the applications were getting better and, therefore, we funded more awards. If I may give another example from veterinary medicine, which we have been interested in for a long time and had had a lot of problems in getting good applications in certain fields. We realised that this was because there were great deficiencies in Britain, for example in relation to studying diseases in cats and dogs certain essential reagents were not existent, so we set up a special programme, a sort of competition, to develop these reagents and we now have them available for studying these disease. So in stimulating neglected areas we have two mechanisms. We go looking for places to train people and/or we advertise a competition.

968. The research councils have all been given in the White Paper mission statements of a much more detailed kind than they have had before and with a bite to them that they certainly have not had before. Do you think that is going to make any difference to trusts, foundations like yourselves? You have a great benefit in Wellcome, as does Nuffield, which I know

[Chairman *contd.*]

a bit about, of really only having the gentlest indication of what one should and should not do. With the research councils proper being somewhat more disciplined in future than they have been, will this affect you?

(*Dr Ogilvie*) Time will tell, I think has to be the answer. I do not know yet. I cannot answer that.

969. That is not something that is worrying you particularly then?

(*Dr Ogilvie*) Not yet.

(*Prof Sir Stanley Peart*) No, it is not. I actually think our conversations with our colleagues in the research councils—and I put that term advisedly, are essential and we see the need to have discussions continuously. It would be very foolish to be putting similar efforts into similar areas. That would be wasteful even though I do believe the idea you should not fund something just because somebody else is doing it on the other side of the Atlantic or the other side of somewhere else, is not right. I believe that it is important to have a different approach to the same sort of problem, but although I think the collaboration effort will go on and progress, I would not like to be tied down to some sort of mission-oriented world. I just do not have any great faith in that at all. I would just like to look at the people handing down the mission first.

Earl of Selborne

970. Could we follow that up because in your remarks you clearly equate the statements of requirements to have a clearer mission statement with industrialists on top and scientists on tap. I go back to Dr Ogilvie's original opening remarks. Do you see these mission statements as something which are more appropriate to industry and rather less appropriate to a research council's remit?

(*Dr Ogilvie*) I think I would have to say yes, because I find it difficult to see how you can simultaneously pursue basic science at an international level and satisfy the needs of users which are not even expressed.

Lord Dainton

971. Following that up, my Lord Chairman, and looking at the structures which are proposed, with one extra research council, each of them protected by Royal Charter and so forth, who is going to look at the whole field? There are analogies in your own particular area. You have a vast range of clinical problems. We also have a vast range of different basic subjects which may feed into that. Would you be concerned, based on your experience, that, having all these research councils with their separate missions, their separate priority setting may let things go the wrong way? Nobody will be taking note of you, or is that too simple a view?

(*Prof Sir Stanley Peart*) It is going to depend really upon the breadth of vision of the people on those councils, I think. If I look at my own experience in medicine and I look at a lot of other people's experience, what is needed are people who can bridge. What one is saying is there are no barriers in research.

972. But there are barriers between the research councils?

(*Prof Sir Stanley Peart*) Well, I suppose there are. I would hate to think that they were as rigid as you might imply by that question.

973. Well, magnetic resonance imaging which you gave us as an example was one which was forgotten about and so, if I may say so, and thank you for saying so, is taxonomy.

(*Prof Sir Stanley Peart*) That is true, but as you look at the major scientific advances which have influenced medical concepts, what they have involved is a washing away of the barriers between the different subjects. I would hate to think that we are so blinkered in this country that this affects the people on the research councils who ought to be chosen for qualities which go across many disciplines. Some of the people now entering science may be very blinkered, one of the problems which goes right back to initial education of course, but I do not want to start on that. However, the people on the councils and particularly the chairmen, I should hope, look sideways.

Chairman

974. I think it would help us to understand some of the things that you have said if I just ask one or two questions about how you operate. How much, for instance, of the money that you had this year was committed last year to all intents and purposes?

(*Dr Ogilvie*) About 25 per cent of our fund is currently committed for the next five years.

975. Only 25 per cent?

(*Dr Ogilvie*) Yes.

976. So you could spend 75 per cent of your money next year on anything you chose? Is that right?

(*Dr Ogilvie*) Yes.

Lord Chorley] 25 per cent in the next five years.

Lord Butterworth

977. Does that mean that you can generally fund something for a number of years, that is to say, you earmark this year for a three-year run?

(*Dr Ogilvie*) It depends on how you organise things financially, but the 25 per cent I am talking about relate to programmes or fellowships that we have funded in past years which will carry on for up to five years in the future so we have 75 per cent of our funds which we can allot this year.

Chairman

978. Let us put it in pounds. You spend about £200 million a year?

(*Dr Ogilvie*) That is the total, including everything that we do.

979. At the beginning of this year, this financial year, how much of that £200 million could you spend on anything you liked, less administration and all of that.

(*Dr Ogilvie*) About 75 per cent.

Chairman] That is what we thought you said.

Lord Dainton

980. How does it work out if it runs on for more than two years?

(*Dr Ogilvie*) Much the same figure at present, but that will change rapidly in the next few years once the major centres of which Hinxton Hall is one are fully up and running.

Chairman

981. This is partly because your money has been growing rather rapidly?

(*Prof Sir Stanley Peart*) It has grown rather rapidly in the last two or three years, therefore, we could not possibly have spent it except unwisely if we had just said that we will just spend it because we have got to project now what we will do. The applications coming in to us at the moment are literally vast as are the sums of money that are involved. We are going through this exercise at the moment to predict where we should be in five years' time, so we have got to be rather cautious. I must say I personally take a rather cautious view to this sort of expenditure because what I have noticed is that the cost of everything is vastly increasing. The cost of a single senior research fellow, for example, is something like £1-1½ million over five years, which is very big money. The cost of some of the schemes is reflected in the cost of Hinxton Park, which we have not yet seen the end of, and I would be surprised if we came out of that under £100 million or more. Therefore, one has got to be rather cautious, about our expenditure. We do not want to be spending our capital.

982. But you do have quite a lot more flexibility, it seems, than the research councils do.

(*Prof Sir Stanley Peart*) At the moment.

Lord Porter of Luddenham

983. This is, you explained, partly because the amount has increased, but it cannot be all that 75 per cent.

(*Prof Sir Stanley Peart*) It has gone up.

984. I take it most of your grants are for one year.

(*Prof Sir Stanley Peart*) No, they are not.

985. How can you manage on that 75 per cent of your income? As I see it, that would mean that only about one-quarter to one-third of your grants go on for a second year.

(*Dr Ogilvie*) About 25 per cent is committed for people who are funded for up to five years at a time.

Chairman

986. But assuming you spend all your grant money and you spend it all on five-year grants, which you do not, I am sure, but if you did, then only 20 per cent of your money would be coming up for grabs each year.

(*Dr Ogilvie*) But the reason why we have such a low percentage committed at this particular time is because we doubled in size a year ago from £100 million a year to £200 million a year.

Lord Dainton

987. Nemesis will come to you one day!

(*Dr Ogilvie*) If we are not very cautious, yes.

Chairman

988. So this is very temporary.

(*Prof Sir Stanley Peart*) This is going to be very temporary, yes.

Lord Chorley

989. When you get back to the plateau, the very high plateau, what would you want to have as your flexibility then?

(*Prof Sir Stanley Peart*) It would be worth addressing the distribution of some of that money because project grants take up a very large amount and that is the three-year type of grants. They take up roughly 40 per cent of our disbursements. Because of the introduction of an extended career fellowship scheme that is going to take up an increasing percentage and we have got to be very careful about the implications of that, because it will engender further demands upon the running cost funds. That is inevitable if we expand it, so we have got to be extremely cautious about our predictions there. We have of course attached importance to the failing structure of buildings in universities, and we are being increasingly approached to supply buildings. Now, as you well know, with buildings comes insurance, heating, lighting, all the overheads that we are being requested to supply and yet we cannot since we would have a lot of money swallowed up, and we think in a way is the proper responsibility of the university. I have to repeat that we want to be science-led and not building-led and we look at this rather carefully because universities actually must look seriously at their policies about what they really want to be prosecuting in the future, so we enter into a very close dialogue about these matters as the amount of money we are being asked for in these terms is very large.

Chairman

990. We have talked about the White Paper. It is good words, but we do not yet know how it is going to operate, but it is also an opportunity, one hopes. What opportunity do you see in it?

(*Dr Ogilvie*) I see the opportunity to really address the issue of the interface between basic science and industry which we are very concerned about. The Trust has a particular difficulty here which I will not bother you with, but is related to our charitable status, but we have put a lot of emphasis in the Trust on building up a cohort of scientists who are also good clinicians. It seems to me that one of the things that is most missing for our purposes, because we fund through the universities, is a good technology transfer section in the key universities. Some of them have started up activities of this kind, but they are not operating well in all but one university in our experience and our experience is based on comments we have from people we are funding. It seems to me that one of the things we need to work together on is to develop cohorts of "bridge" people, people who are equally at home in research and also know what industry wants i.e. who know about technology transfer. I would suspect that that is one of the key things we need, cohorts of dual trained people of this kind.

991. Have you talked to BTG about that?

[Chairman *contd.*]

(*Dr Ogilvie*) BTG are currently advising us on our own problems in this direction. We are particularly talking to our key universities which are, as you would imagine, Oxford, Cambridge, University College London, Imperial, Edinburgh at the moment. The problem of protection of IPR and technology transfer is a key issue for us and one in which we are actively engaged. We are not against principles of wealth creation in the White Paper at all; far from it. Of course it is an essential way for the country to go, but I think that one of the things that is really missing, is a really professional way of integrating industry with the basic science by developing appropriate skills within our main universities.

Lord Dainton

992. BTG told us that they thought that the universities were rather poor at this on their own and in a sense that could have been a sales ploy of BTG, "Come to us and we will solve your problems," as it were, but some universities are in fact trying to do this. Would there be a possibility of Wellcome, seeing this as a role which they could fill but government might not, putting special funds into universities to facilitate this transfer?

(*Dr Ogilvie*) We have to be very careful to do this in terms of our charitable status but it is an issue which the White Paper has been really helpful to us on in our dealings with the Charity Commissioners. We are very serious about this and are tremendously committed to doing what we can about it because we are well aware that the biomedical sciences will produce opportunities for the universities, for industry and for the country, as never before, so we are addressing it in a very aggressive—in the right sense of that word—way. Most of the universities are inadequately equipped in this area at present.

993. But it will create a problem for you with the new Charities Act?

(*Prof Sir Stanley Peart*) That is the problem actually because we have encountered quite recently a problem in this area which revolves, of course, around intellectual property rights. These are major universities we are talking about, and if there is a company involved where a profit might accrue from work we have supported, we run straight into a problem, which I actually think requires a governmental decision to ease the way in relation to The Charity Commissioners, because it seems very silly to me that we cannot take advantage of any idea, wherever it comes from, and really make it work.

994. It is odd. It produces a tax-deductible situation which then will finance private industry because they will be able to take it up?

(*Dr Ogilvie*) May I give an illustration. I had somebody on the telephone this morning from one of the major universities on this very matter. They had put in a patent application for one year for a particular potential vaccine development arising out of a Trust grant. The university concerned has not aggressively tried to transfer this patent to industry and are now proposing simply to drop it. They do not realise—or haven't the resources—to do as the American universities do, protect patents for at least five years, which costs in American terms $30,000 per application, and this particular major university needs to put at least £1½ million a year to protect the patents which they have on their books right now. Also they seem to not have the people to go out aggressively and sell their patents to appropriate industries. This weakness in our universities is what I think we need, all of us, jointly to address.

Chairman

995. Are there any more questions?

(*Prof Sir Stanley Peart*) No, I think you have heard enough!

Chairman] Then thank you both very much for coming. It has been a fascinating afternoon.

Supplementary memorandum from the Wellcome Trust

Question 3

Can you point to areas of medical research where the system of priority-setting appears to have failed?—i.e. where work which is second-rate, pointless or the proper business of industry is receiving funds, or where excellent and worthwhile work is unsupported?

Answer

What do you mean by "system of priority-setting"?

We do not believe grants are given for the support of second-rate science or individuals. However, because the outcome of research is by definition unpredictable, not every funded project will be equally productive. We know however that over 95 per cent of our grants produce at least one publication.

The Wellcome Trust does not support research that is the proper business of industry. We suggest you ask the cancer charities whether any of the pharmaceutical companies in the UK has a serious interest in the production of anti-cancer drugs.

Many of the applications that we are unable to fund are probably worthwhile, but in our experience, the definition of excellence is to some extent related to the availability of funds.

Question 4

In what respects are your mission and modus operandi different from those of the MRC?

Answer

The Trust is required to support medically related research to "improve the physical welfare of mankind". The Governors of the Trust interpret this instruction widely and include veterinary research within it. We use similar mechanisms of peer review to the MRC (as do all members of the AMRC) and indeed fund the same community. We are also within the UK geographically neutral in that we make grants on the basis of the scientific case without regard for the location of the applicant. Thus, most of the scientific community that receives grants from theTrust would not perceive many differences.

However, the Trust is an independent body run by a Board of Governors. As a matter of policy but not of necessity, the Trust allocates most of its resources to activities within the UK. However the Will which governs the Trust does not permit the Trust to assume responsibility for the maintenance of the strength of UK research which must be the business of government. The Trust can and does fund research outside the UK—in the USA via the Burroughs Wellcome Fund and in the Republic of Ireland and on a small scale in many other countries via Fellowships.

The Governors of the Trust have a dual responsibility to maintain and enhance the endownment left by the founder and to use the income according to the instruction in his Will.

Question 6

Are the funds available for grants divided among your grant panels, or allocated from a single award point as in the MRC? If each panel receives a budget, how do you set the budgets, and how do you maintain comparability of scientific standards? If you operate a single award point, how do you apply a single standard across such a diverse field?

Answer

Each panel works to a budget which is set annually and reviewed half way through the financial year. For the past several years, it has been possible to set the budget according to demand. For example, neuroscience has been the most rapidly growing area and the budget has grown disproportionately in recent years. The funding rate of each panel is watched continually and budgets adjusted in the ensuing year to ensure comparability. That is, comparability is maintained by budgetary means. Also there is cross panel representation by senior staff and panel membership rotates regularly. Panel members are very thorough and we believe standards have increased as the Trust's income has risen. As the peer review process increasingly involves scientists from other countries especially for major applications, we are confident that such grants are internationally competitive.

Question 7

Do you support work conducted or supported by industry?

Answer

No. We have to be particularly careful to disassociate ourselves from such funding to preserve our independence from Wellcome plc and protect our charitable status.

Question 8

Can you envisage circumstances which might cause you to change your policy of not supporting research outside the British Isles?

Answer

The Trust already supports research in other countries through its extensive programme of overseas fellowships, in the USA via the Burroughs Wellcome Fund, and in the Republic of Ireland. The Trust can support research anywhere in the world. Future policy is a matter for our Governors and will depend on Government action.

Question 10

You say that you take responsibility for "the sciences basic to" the biomedical research which is your main mission. The Science White Paper puts each Research Council in a similar position, with a mission, and a responsibility towards the relevant basic science. Is it ever difficult to decide whether a particular field of basic science underpins your mission or not?

Answer

No.

WEDNESDAY 3 NOVEMBER 1993

Present:

Butterworth, L.	Flowers, L. (Chairman)
Chorley, L.	Porter of Luddenham, L.
Dainton, L.	Tombs, L.

Memorandum by the Confederation of British Industry

INTRODUCTION

The CBI represents the interests of close to 250,000 companies nationwide. One of its key aims is to promote the long-run international competitiveness of UK business as a whole.

RESPONSES TO QUESTIONS

1. *What is public expenditure on the science base for?*

There is a strong case for a national capability in a broad spread of fundamental scientific and engineering disciplines over and above activities being undertaken in the private sector. These capabilities can be divided into three categories as follows:

(a) Meeting the needs of society:

Basic social needs—food, health, energy, infrastructure, and environmental protection—are, amongst others, the components of a nation's quality of life and require basic research to understand their fundamentals and solve short and long term problems. There are major scientific and engineering dimensions to these areas where Government has some or all of the responsibility to meet research needs, especially those demanding longer term work where the market system may not operate effectively. Additionally, it should be remembered that basic science makes an immense, largely unquantifiable, contribution to Britain's literary, artistic and cultural fabric.

(b) Meeting the training and skill needs of industry:

Research in our universities and institutes is an essential component of training for industry's future scientists and engineers. The CBI is committed to spreading best practice within UK manufacturing industry and has highlighted the need for more world class UK companies [1]. It is implicit that this requires scientists and engineers of world class training with a capacity to solve fundamental science and technology problems. Public funded science basic research provides this vital pre-employment training.

(c) Meeting the science, engineering and technology needs of industry:

While there are examples of linear technology transfers from basic science to products in a number of areas, notably biotechnology and materials, in many more cases the technology transfer route is complex and ill defined. However, basic research in key industrial areas remains crucial to the future capability of UK industry to generate new products and processes. While it is the responsibility of industry to fund research leading to commercial products, basic research results arising from publicly funded projects, which would not necessarily be carried out by industry, are widely consulted and exploited by private companies.

However, given the large sums of public money involved it is right to set priorities and focus on exploitable areas in tandem with efforts to identify market needs and technology capabilities. The OST's Technology Foresight Programme is therefore supported by the CBI, since it will assist in setting national priorities and facilitate cooperation between academia, industry and government.

2. *What are the objectives and priorities of the various funding agencies within Government, Research Councils, HEFCs, other departments? Are they related? Is an overview required, and do existing structures (ABRC, OST, ACOST) provide it?*

The CBI welcomed the setting up of the OST with the appointment of a minister for science in April 1992, because of the CBI's belief that an overview was needed. More recently it has generally supported the contents of the Government's White Paper "Realising Our Potential" with its implicit recognition that wealth creation should lie at the heart of national science, technology and engineering objectives. The CBI argued in its submission to the Science White Paper on Science, Technology and Engineering that Government, industry, academia and the investment community should work in partnership to set national objectives for science and technology [2]. The Council for Science and Technology, as proposed in the White Paper, could, if properly structured, make an important contribution to this process.

3. *What are the relationships connecting Government funding of the science base and funding by industry and charities and overseas funding (particularly from the EEC)? Various people are paying the piper; are they calling different or incompatible tunes, and if so is this a bad thing?*

The relationships are complex, but it is clear that a number of projects are heavily reliant on cash for basic research from sources other than the UK Government. As implied in the question, the charities play an important role, particularly in supporting medical research, though other trusts and charities support projects in a number of other science areas. Industry itself makes a significant contribution, though inevitably the main direction for funding by industry is nearer the market.

Another important source of funding for universities and industry is community support under the Framework programme. For industry, funding is granted to pre-competitive projects—a term which is not synonymous with that of basic science but indicates a distinction from "near market". UK companies engage in EC funded research for a number of reasons including building links between other companies with whom they would not normally collaborate. The CBI believes that monies won by companies from Community funds should be treated as additional to UK national science funding—a policy which the UK Treasury has not yet adopted, but which is a widely accepted policy of other member states.

Clearly then, various people are paying the piper. Community funding is bound by the principle of subsidiarity and therefore should be compatible with national science funding policies. In the case of charities, it is for them to explain their funding policies as this falls outside the CBI's remit. From industry's point of view, funding of university projects is aimed at meeting a set of varying objectives. At one end of the spectrum research skills of a university department may be sought directly to meet a specific research need of a company, with the results being the sole property of the funding company. This is normally termed contract research. Companies also fund collaborative projects which tend to be more speculative and closer to basic research. There are also examples of straightforward donations to support specific science base areas.

In recent years universities have adopted a more business-like approach, recognising that with shrinking resources, a key asset is their science and technology know-how. This is leading to improved links with business and to more commercial agreements. In terms of more fundamental scientific research where there are fewer commercial outcomes, public funding must remain the principal support mechanism nothwithstanding that money generated by universities from the private sector should on the whole be treated as additional to core funding for basic research.

4. *What information and advice is needed by those who are setting priorities? How do they know what is going on in current low priority fields? How do they track developments overseas?*

Those setting priorities need to consider a number of factors. They need to agree on a mission and a set of objectives. These could include a number of objectives but the CBI believes that the primary one—though not the only one—should be the aim of generating wealth for the nation as a whole. However, account has to be taken of those other points outlined in question 1. A number of criteria need to be added, those of excellence, quality, and of diversity. Reviewing processes based on the judgement of experts—peer review—is likely to be the most effective mechanism to set priorities within particular science fields. More problematic is how priorities should be set between fields eg in deciding whether biological sciences should receive more or less funding than say chemistry based disciplines. The CBI believes that one approach is to use the foresight process, but it is crucial—in meeting the primary objective of wealth creation—that this asks what the needs and demands of society, consumers and markets will be in five, ten and twenty years' time, rather than approaching the question from the science end on its own. The CBI believes that a purely science-led process, lacking the considerations of market, consumer and social demands, will not work. It is important also to note that companies are increasingly competing for a share of global markets, and therefore an international dimension must be added to these considerations.

Additionally, low priority fields must not be ignored, and the importance of maintaining some diversity outside the core areas is important. This can be achieved by allowing some funding for unsolicited or undirected research providing it meets the criteria of excellence.

5. *How do charities and companies which fund research set and implement priorities? How is it done overseas? Are there lessons here for Government?*

Companies set their own missions and business objectives, and fund research which they believe will meet those business aims. Multinationals are not bound by the need to establish research facilities in the UK and in considering their investment, will look closely at the science base, the skill levels of the human resource and infrastructure, alongside considerations such as the financial and regulatory environment. The UK has been successful in attracting inward investment in a number of high technology areas (eg pharmaceuticals and electronics) and this in part is due to its strengths in certain science and technology fields. Many companies carry out their own "foresight" procedures which are used in planning long term business strategies and it is likely that these approaches could provide useful information to the OST Foresight exercise currently being planned. It is also well known that Japan and a number of other countries carry out national foresight exercises and it is plain that the UK should be attempting to learn as much as possible from these methods.

References

(1) Making It In Britain—Partnership for World Class Manufacturing. CBI 1992 p 62.

(2) Innovation—The momentum for Competitive Success. CBI Policy Paper November 1992.

Examination of witnesses

Professor Brian Mellitt, Director of Engineering, London Underground, Mr Don Lennard, Chief Executive, Marine Technology Directorate Ltd and Dr Simon Shohet, Policy Adviser, Technology Group, Confederation of British Industry, were called in and examined.

Chairman

996. Thank you very much for joining us today. Thank you for the various pieces of evidence you have given us, both now and in the past on topics we have been looking at. We always expect to get something good from the CBI and usually do.

(*Prof Mellitt*) Thank you. Could I introduce my colleagues. Dr Simon Shohet, who is a CBI officer, and Don Lennard, who is the chief executive of MTD. Don's activity is particularly germane to this matter and I would ask him to say something about MTD before we start.

997. Could I start by setting the scene? You put in evidence to Mr Waldegrave what you hoped the White Paper would contain, and so did industry generally, not only through you. Since the appearance of the White Paper there has been a singular silence from industry and therefore we really do not know what the reaction of industry to the White Paper is. One of the things we would like to get from you, if we can, is some sort of succinct view, if that is possible, about the White Paper and about the way forward from there.

(*Mr Lennard*) I think, my Lord Chairman, the organisation I run, which is a privatised part of one of the research councils, is probably a good example of the way in which industry is working with the Cabinet Office and Government. You will know, my Lord Chairman, the Science and Engineering Research Council establishes directorates when it wishes to work in a particular area, and the only one they have privatised is the one I now run. We have some 70 companies in membership, three government departments and a number of universities and HEIs in general. Our patron is the Royal Academy of Engineering. It enables us to bring together the views of industry, which is perhaps a first part of the answer to your question, together with those of the marine technology part of the academic community. We have, since the White Paper, made further submissions to the Office of Science and Technology. In fact it is fair to say we have about a monthly meeting with either Professor Stewart or one of the other officials. In fact Professor Stewart asked the whole of his Technology Foresight team—or should I call it the Foresight team now—to visit MTD because it was felt the methods we used for both technology and market foresight had some helpful indications as far as they were concerned. I think the principal point I would like to make is in response to your particular question, that certainly a reasonably large sector of the marine industry, predominantly the offshore oil and gas industry but also the shipbuilding side, has provided some further responses through MTD.

998. Thank you very much.

(*Prof Mellitt*) Could I start, my Lord Chairman, by saying that the written submission which you received from the CBI is formally not a document endorsed by the council as such, largely because of timing. This is a document which comes from the part of the CBI which is charged with technology and innovation essentially, and this is the group which we belong to which has been handling the CBI's assessment of the White Paper and associated topics. It is important, we believe, for Government and the user-community to understand innovation is more than simply technical innovation, it is an attitude of thinking and a mind-set, and we are the group which have been particularly concerned with trying to develop innovative thinking in every sense of the word within British industry. You referred to not having a response from industry, one of the difficulties of course is that industry is a many headed hydra and in a sense the CBI, through its own committees, attempts to try to make a presentation on behalf of industry. We are very interested in the White Paper, we believe for engineering and technology the thrust of this White Paper is broadly correct. There are issues about size of company which perhaps we would like to raise with you, but fundamentally we support this and we believe those of our members we have been able to talk to support it because they see the value for money aspects of research and development being something which is the key to this particular policy. We would like to deal with your specific questions, Sir.

999. Thank you very much indeed. One of the pillars of the White Paper is the idea of the Technology Foresight Programme, which, as far as I have understood it, is a bottom-up knowledge network, call it what you will, within which everybody will try to work out the future and guide their own actions accordingly. First of all, are you contributing in any way to the construction of the machinery which is to give effect to that, and what are your expectations of it?

[Chairman *contd.*]

(*Dr Shohet*) Yes, indeed, my Lord Chairman. The CBI has opened its doors to views from OST as to how the Technology Foresight process should be handled, and we have been very positive in feeding comments back both practically and in other ways. We hosted a seminar fairly recently at our headquarters in Centre Point and we tried to get a cross-section of companies to that meeting, which William Waldegrave himself addressed along with Professor William Stewart. We see it as having various facets. First of all, it contributes to the partnership process which we believe is very important to the whole ethos of the White Paper. Industry is very keen to provide expertise and is able to give its own experiences from the Foresight practices which it has been using. It meets to some extent the strategic over-view we have been asking for on science, technology and engineering, and hopefully will provide that policy direction. But we have been concerned about the short timescales involved in implementing the Technology Foresight process. We feel wide consultation is necessary and we believe that is now happening. The CBI has been contributing to that too by spreading the word among its regional councils and alerting CBI members to the Foresight process at that level.

1000. Can you also say a few words about how you see the Technology Foresight Programme being put to use? For example, is it going to be as I described it, a "knowledge network" that will guide people to do their own thing in the light of this new knowledge, or is it going to be a device to enable the DTI, or somebody, to direct the flow of funds in certain directions, rather than others? How do you see it being used?

(*Prof Mellitt*) You clearly raise at least two possible ways it *may* be used, but I think how it *will* be used depends upon the commitment and involvement of various interested parties. I think for it to be successful, it has to be a forum where there is a coming together of understanding of need and this is quite difficult because some members of the user community, perhaps, have a different perception of need. I think if it is properly managed it can effectively be a national forum of understanding where we need to make effort. This is not an easy issue. People who have research careers know that it is quite difficult to be able to predict need accurately, but I think we can actually identify major areas of need, and if we try to provide the networking that you coherently describe, then I do not think it ought to be a vehicle for overly prescriptive direction, which I think was implied in your comment. Maybe Simon will pick up on any further detail.

(*Dr Shohet*) I think that is right. We have been concerned that it is not just an identification of technologies, but that it looks to the needs of society, in a very broad context, of consumers in a market, and that it is approached from that end. That makes it all the more difficult in some ways, but we believe that it is an important activity to contribute, and not to be set in stone as the only policy to be used by Government in setting priorities, but as a guide, along with other things that we should be doing.

1001. Could you reasonably describe it as an attempt to form a vision of ten years hence towards which you are groping your way?

(*Dr Shohet*) Yes, I do, but I think very much, from the consumer end point, rather than the view, perhaps, of the scientific community.

Lord Tombs

1002. You represent nearly one-quarter of a million companies and that is quite a task because they are quite diverse companies. Some are very large, with very good links to the science base already, but some are very small and largely indifferent to the science base. So your task is to formulate a response to the White Paper from this broad range of interests. Into this comes the question of leadership and representation and I would really like to know how you see this challenge to leadership, if you like, because it seems to me the DTI have their own links too—particularly to sectors of industry—which may, in all honesty, be better than yours, in particular cases. So there seems to be a lag between (what I might call) the well-developed areas and less developed areas which you might represent, and I would be very interested to hear whether you would agree with that differentiation and how you would tackle it.

(*Prof Mellitt*) I think the point about differentiation is well made. One of the issues we have faced so far is in talking to different companies, or to representatives of companies regionally, and we find some people very well informed about the White Paper—very knowledgeable, understanding the research process, existing research programmes, contributing to LINK, for example—and equally we find some companies who, frankly, ought to know about it but do not. I do not think we have any magic formula, other than simply through our membership talking to people, making presentations, and trying to explain particularly to the smaller emerging companies the benefits of learning from other people's knowledge. We see that as a model that can be developed and progressed, but we are conscious that GEC is, for example, rather well connected, whereas the average small manufacturing company does need help. However, we have had several presentations now and we believe that we have had some positive responses. An important thing from our perspective is to ensure that in this proposed process we get the right people from industry making contributions. From my own perspective, I would say that in the past there has not been as strong a representation, perhaps, of the needs of industry in research funding applications as there may well have been. Don, did you want to pick up on that?

(*Mr Lennard*) Only to say that the Technology and Innovation Committee of the CBI, which has about a dozen members plus CBI staff, has been going out into the provinces and speaking at a number of regional meetings to groups from industry, which have produced the answer you have just heard. Some of the industry representatives have not even heard of the White Paper and so on. But I think with the "cascading down", that is the best way we can proceed. If I may pick up the point about small companies not necessarily following this through and

[Lord Tombs *contd.*]

having the right knowledge base, I think one has to be extremely careful here. In certain sectors, some of the smallest companies are at the really sharp edge. I am thinking particularly in Aberdeen where there are two or three-person companies, who really give the very best service to the oil companies in terms of taking their technology into deeper water and so on. We do not need to convince those people. They have heard of the White Paper, despite working all the hours there are to get their new services and products out. I guess a question, my Lord Chairman, that we all need to ask is which part of the industry community should we be targeting? I do not believe—and I think I speak for the CBI too—that we can expect 90 per cent of the industrial infrastructure of this country to be interested in, or react effectively to, what the White Paper is seeking to achieve. Perhaps our best way is to try to locate those who are going to respond positively.

Chairman

1003. Are you describing a situation which happens to be so at this moment, or are you describing what things ought to be like?

(*Mr Lennard*) In certain narrow sectors, I believe it to be true now, so our job should be to spread it to all the relevant sectors. If you ask me to quote a figure, I would say that we are 10 per cent successful from those that we should be getting to.

1004. And what are you doing to spread it yourselves?

(*Mr Lennard*) Again, I can only speak for the sector that we are with. We are seeking to recruit the small and medium-sized enterprises. We get the oil companies and we get the big contractors. Particularly working with Scottish Enterprise, for example, we are bringing in some of these SMEs in the Scottish area working for the off-shore industry.

(*Dr Shohet*) Could I just add, my Lord Chairman, that the CBI is an umbrella organisation which also has trade associations as members in their own right, and we have tried very hard to raise the awareness of this amongst the smaller trade associations. Clearly the larger ones are fully aware, but we see our role in the sort of horizontal sense, as being cross-sectoral in representing companies and also to feed across to the trade associations of particular sectors who can then link in with their specific technological areas.

Lord Porter of Luddenham

1005. The point has been made to us on the Technology Foresight Programme that the process is more important than the product. Certainly the process is more likely to be of value than the product, or successful. I was impressed by this point because there seems to be general agreement that the process will, as Professor Mellitt described, bring together the academic and industrial partners to discuss these matters, and this will be of undoubted value—just the bringing of them together. However, whether there will be a product at the end of the day which is a clear one, other than the individual products of the people who have learned by coming together, is not so clear. Would you go along with that or do you really think we can expect some clear decisions on what is the way forward—and that the crystal ball is going to be very clear?

(*Prof Mellitt*) I am very sympathetic to the view you express. I think from experience in other places, that where people who have been relatively closeted in what they do, are exposed—albeit at some remove—to people who might be called customers, and who are interested in what they are doing and a dialogue ensues, then by and large both parties seem to benefit. It seems to me that perhaps cultural change, which is what I think you are talking about, within the research community is likely to occur if some of their industrial counterparts have broad knowledge but are not handicapped by the experience of having done research. There is a robustness about that which I think will lead to change. My own experience, and experience of other colleagues who have worked at the academic industrial interface, is that the networking and bringing together of understanding of the problem is often a very efficient way of defining what is worth doing. Because I do believe that you can progress beyond that, I think ultimately there will be a product but I would not be confident whether it will be in five, ten or fifteen years.

1006. On this interface, in your experience, what do you think are the difficulties of crossing those bridges and barriers? I am thinking of the direction in particular. Is the resistance uni-directional? Is the resistance from academia to industry or would you say it is about 50-50? Are the industrialists flooding in to cross the bridges?

(*Mr Lennard*) More than anything else it is the two sides getting to know each other. Ours is a very inter-disciplinary business, so we are getting aeronautical engineers, for example, talking to shipbuilders. Certainly when we started, which was 1976, there was not a great deal of understanding of the other side. We have now got a network—you used the term—of far more than our industrial member base (300 or 400 companies, and about the same number of academics) who know each other very well and know the limitations of each side and the strengths of each side too. I really do not think for any particular sector you can achieve that trust in less than about five years. We are talking about, I would suggest, a longterm activity here. Answering your earlier question, we are not in the business of crystal-ball gazing. Our main problem is to seek to find the generic technologies (which is a phrase which keeps coming up in the White Paper) which are common not just to our different disciplines but are of interest, for example, to the motor car industry, the aerospace industry as well; technologies like statistical engineering analysis which has not been used in the offshore industry but has been used in missile launchers and is now in Ford Transit panel vans surprisingly.

Chairman

1007. You used the phrase, Mr Lennard, "generic technologies", and at earlier stages we have heard about strategic science and now it is generic technology. There have over many years in this country and in many other countries been sporadic attempts to find out what are the areas which are

[Chairman *contd.*]

most likely to lead to profitable development. What is new in this particular one spelt out in the White Paper, or is it just another framework for exactly the same thing?

(*Mr Lennard*) My Lord Chairman, it is certainly another framework. I hope and believe it is not just that. It seems to me for the first time we have a lead from the top which is seeking to determine the common features in our industrial activities now. I say again, we are not in the business of crystal-ball gazing, we are looking for the areas where in five, ten, fifteen years (which were the specific periods we at one stage mentioned in the T&I paper which has not yet come to you) growth can be seen. Perhaps a point to remark, my Lord Chairman, is that I think it is fair to say the Technology and Innovation Committee feel very strongly that the term "technology foresight" is a misnomer. Foresight by all means, but market foresight is at least as important as technology foresight, and I say that as an engineer.

Lord Tombs

1008. I would like to come back to the point I was developing earlier, which is that of a two stream system. I think the White Paper opens a lot of doors which I find welcome but the question is how well we can go through them. It seems to me a real danger is that the very large firms with well-established links will continue to make the running, and there needs to be a forum for the rest of industry, by which I mean the small and medium sized firms. I must say the exceptions are switched on. One would want to hear their voice clearly enunciated in any Technology Foresight Programme or any research programme. It seems to me that this role, unwelcome though it may be, falls to the CBI, *faute de mieux*, because there is no other forum. I would like to know whether you agree and, if so, how you are going to encounter this two stream system of advice, where the DTI and the large firms are very closely linked—and I would not just include the large firms, I would include Mr Lennard's very high profile outfit, which I had a little to do with setting up when I was at the SERC, and it has done very well but that is the exception and not the generality. I am concerned with the generality of industry, small and medium sized, and how their voice becomes recognised, enunciated and pressed.

(*Prof Mellitt*) Certainly the CBI recognise it is the conduit for such companies, and certainly in our Technology and Innovation Committee we have debated how we might progress that.

(*Dr Shohet*) The point you make about larger firms being able to plug into this activity better than small firms is, I think, a very important one and one that we acknowledge as a potential problem which may distort the outcomes. One thing which the CBI has been keen to push forward is the idea that large firms are actually reliant upon smaller firms as suppliers as well as component suppliers as well as all kinds of other sub-contracting activities, and many of them are very high technology activities. We feel that encouraging the larger firms to involve their smaller firm suppliers in this process could help. We can look at other models where this has been attempted in terms of the European Framework Programme, where the same problem has arisen, of the smaller firms being able to participate, and one approach has been to try and get a consortia of small firms together which collectively have more of a say and strength in what they can put forward. Perhaps that could be used as a route to this as well. I agree that it is a difficult problem.

(*Prof Mellitt*) I think you have highlighted in your question, Sir, an important issue which perhaps we would like to consider and perhaps give you a written response to, because it is an important issue. It is naive to believe if we get involvement everybody can contribute equally. One has to recognise that there are players who would contribute more than others, but perhaps we can give you a written response.

Chairman

1009. How do you see the contents of the White Paper affecting the way that priorities for the science base are set by the research councils and by others?

(*Prof Mellitt*) It is our belief that if the policies described in the White Paper are implemented, then there will be changes of key individuals within the research councils, there will be industrially-nominated individuals who are working to a somewhat different brief from the one they currently do. I believe, and we believe, that involvement has to be at the board level, and that has to set a framework whereby criteria for judging specific proposals more related to output measures than input assessment, for example, will begin to be a style for judging research proposals and research expenditure. I think that is a particular process.

1010. Is that the main contribution industry will be able to offer?

(*Prof Mellitt*) I think it is an important contribution.

Lord Dainton

1011. Is there not a difficulty that this will affect the science base? Namely that it is driven by those considerations alone and then ten, twenty years from now you will not have the lively science base you need?

(*Prof Mellitt*) I do not think, my Lord, it will be driven by those considerations alone, because I am very clear that the spirited and lively people from the academic communities who are representatives at the most senior levels of the research councils will ensure that their voice and their general interests are represented. It is a question of balance. I was asked before, and I am sorry I did not respond adequately about where the hold-ups will be. I think, within the academic communities, that there is a structural issue, as long as within universities the peer evaluation system does not credit industrial linkages; that is true is some areas but not in others. But that is one of the issues. Equally, on the industrial side—it comes back to Lord Tombs' point—for some industrialists it is quite a surprise to realise that there are people in the academic community who are coherent and who can focus on their problem very quickly.

Chairman

1012. Do you see any conflict between the requirement of academic excellence on the one hand, which has driven the Research Councils in the past, and the concept of utility or wealth creation—call it what you will—which is now being put upon the whole system by the White Paper. Do you see any conflict between those two assessment criteria?

(*Prof Mellitt*) I think we see there will be tensions, but it is our judgment that these tensions can be creative tensions, providing the right sort of people are appointed to the Research Councils.

Lord Dainton

1013. How do you see this operating in detail? Would you see, for example, choices being of the kind, "We have so much money in the next five years, so we will allocate so much strictly to curiosity-driven work and so much to Technology Foresight." How do you make that kind of decision? It seems a very difficult one. I can see when you have concrete examples in front of you—

(*Mr Lennard*) In our case—forgive me if I keep quoting this, but that is why I have been asked to come, I think—we reserve one-third of the SERC money for fundamental work, and we fund projects in that area 100 per cent with SERC money. The other two-thirds is then used for—I would not say closer to the marketplace—but projects and programmes which have industrial relevance. We match the SERC money with an equal amount from industry. It is our experience that we can support approximately the same percentage of alpha rated projects, which come to us from that one-third of the funding, which is a third of £5.2 million, as the conventional committees of the SERC. I have to say that with a board which is constituted largely with people from industry, it was they who insisted on a third, rather than a quarter of our SERC funds being used for this fundamental work.

Chairman

1014. Do you see the system, as a whole, working somewhat like that in the future?

(*Mr Lennard*) I believe our model can be used in certainly a number of other areas, but I would not say that it is a panacea for all areas.

Lord Tombs

1015. I just wanted to come back to the point of the chairmanship of the Research Councils, the notion that they should all be industrialists. Pendulums have a habit of swinging to extremes before they reverse their direction and I wonder whether this carries the risk of attention being turned away from fundamental research. Professor Mellitt mentioned—and I think we all know examples—academics who are familiar with industry. I wonder why some of those should not be chairmen of Research Councils. It does seem that we are in danger of overdoing things here in a way which may be excessively utilitarian. I would like to know the CBI's view—if there is such a thing—on this issue as to whether one should have quotas or exclusions of this sort. Should we have so many ethnic chairmen, so many male and female, so many industrialists as chairmen? Moreover, having settled that, should they all be industrialists?

(*Prof Mellitt*) We do not have a formal policy but I will ask Simon to make a comment.

(*Dr Shohet*) We believe that there should be a liberal sprinkling of industrialists—perhaps more than there have been—but not to dominate. We have said in our paper that we do believe that the criteria of excellence of quality and diversity are crucial and have to be applied in any context. The point about having funds available for undirected research which may not be obviously pointing in the direction of wealth creation is important. The question of what that balance should be is the crucial one and it is for such things that mechanisms, like the Technology Foresight, should aid (hopefully) in finding out what that balance should be.

Lord Porter of Luddenham

1016. May I ask what you see the industrialist offering, for example, in the leadership of the Medical Research Council?

(*Dr Shohet*) I am not certain we would advocate that the Medical Research Council should necessarily have an industrial leader.

1017. It has in the past, of course, and he did a wonderful job—because of who he was, perhaps.

(*Dr Shohet*) Yes he did, but the point about individuals, I think, has been mentioned before and this is an important one. If I may follow up your question, we could argue that the pharmaceutical industry is a major contributor to innovation in the United Kingdom and it is a very successful sector. From that point of view, one could argue that the Head of the MRC could be usefully aware of some of the market side of that industry. Beyond that I would not necessarily argue that they should be.

1018. Perhaps it is more biological, rather than physical.

(*Prof Mellitt*) If I could respond, at the seminar which Simon described, at the various work sessions, we went through, "Do we support this?" and "Do we support that?". It was clear that people felt that the chairmen of Research Councils probably should be from industry, I think, for the reasons that Lord Porter mentioned earlier of: it is the process of making a statement. In practice, I think to be dogmatic about such a thing would be foolish and I believe that it is a question of getting the most suitable individual. However, if, for example, there was not a significant proportion of such appointments from industry, then I think that would be giving the wrong message.

Lord Dainton

1019. If I may follow up what Mr Lennard said, you have used the present tense in referring to this original division of one-third basic and two-thirds the rest, and you gave the impression—if I am right in my hearing of you—that this was something that you thought, by experience, might be the optimum. Therefore, I assume—and this is the question—that you do not see that being changed, for all the fine words in the White Paper, is that true?

(*Mr Lennard*) Yes.

[Lord Dainton *contd.*]

1020. And as a supplementary, are there variations across subjects and areas here which should be taken note of?

(*Mr Lennard*) Yes, at the moment, in answer to the first question, we feel that the one-third/two-thirds division is still appropriate in the area where we are working. Between different areas, within our multi-disciplinary sector, yes, we do have variations. For example, when it came to ship safety—an industry which has not been noted in the past for supporting research—the early phases of the work we funded 100 per cent. We were slightly surprised in that we did get industrial contributions. The next phase will be one-third/two-thirds. I think we are fairly pragmatic and we look at this approximately every 18 months.

1021. So, really, in a nutshell, you are the coal-face and you continue to make the decisions that count in the light of the situation which prevails at the time?

(*Mr Lennard*) My Lord Chairman, that is correct. We do consult very widely and I think that is why Professor Stewart invited his Technology Foresight team to come along and hear how we did this consultation in our sector.

Lord Chorley

1022. May we go back to the industrial chairmen, and more particularly to what Professor Mellitt said that the CBI did not have too dogmatic a view on that. One of the things which worries me on the broader basis of the Research Councils, is whether these chairmen who, I think, are one day a week supposedly, which is what the job is sold on, have sufficient time really to get inside what is going on in that research world? Is that a thing that worries the CBI?

(*Prof Mellitt*) I think that is a very appropriate observation. I think the CBI would only be wanting to support an industrial nominee for such a post if his background, networking and general knowledge was such that he was appropriately qualified but, importantly, his company would have to understand the obligations of such a post. Again at our seminar and at various presentations, one of the key issues has been how much time would chairmen and managing directors make available of their senior executives if they were asked to discharge such an obligation. There are differing views. It seemed, though, the consensus debate was that if this really was going to be an effective change, if this really was going to be a way of making better use of government money for not only knowledge creation but wealth creation, it was a part of industry's mandate to be putting that effort in. But I will not pretend that it is an easy issue, because I do not believe it is.

1023. That is one of my chief worries.

(*Mr Lennard*) My Lord Chairman, Lord Chorley has brought in a new point here, the amount of time chairmen spend, and I must confess personally I find this distinctly worrying. A lot, though, does depend on the relationship between the new chief executives and the chairmen and how they divide out their responsibilities.

1024. We both of us have a particular research council in mind, I believe?

(*Mr Lennard*) Yes, indeed. Can I add one point which is relevant to that and to an earlier question? I think in this country we often do ourselves a disservice by compartmentalising people and talking about industrialists and academics. I think of Professor Sir Geoffrey Allen, who was chairman of SERC and became director of research at Unilever, and there are a lot of people like that who have an understanding of both sides of the fence—and I am not sure there is a fence there.

Chairman] Point taken.

Lord Porter of Luddenham

1025. I have a very brief question and I think your answer might help us. As you know, we are looking for means of setting priorities in research and you have a sentence in your statement to us talking about setting priorities and the need to consider a number of factors and a set of objectives, and you go on to say that the CBI believes that the primary one though not the only one should be the aim of generating wealth creation as well. Everybody has said this so we have taken that on board. We know that is one of the means of setting priorities. What intrigued me was that you add "though not the only one", could you give us number two and number three?

(*Prof Mellitt*) The author can respond!

(*Dr Shohet*) Basic science from our perspective clearly has to meet a whole range of other needs, broadly the needs of society and all those things which come under quality of life, which may include health, energy, food, infrastructure, a whole raft of socially important topics. Alongside that, the issue of training I think is important. We believe that research training is crucially important for industry; when scientists are coming from a basic research background into industry, the basic research itself provides a very suitable training for them. Even if the results at the end of the day do not translate into wealth creation nevertheless that experience is extremely valuable from an industry point of view. That is another one.

Chairman

1026. You have just said something which surprises me a little, since you are representing whom you represent. There must be a lot of people in CBI circles who would say that too many of our scientists and engineers are trained in fields which are interesting in their own right but have no likely applicability as far as one can see, and that that ought to change and more should be trained on things which seem more likely to be useful—the transference of skills, and one could argue it a little way. You do not go along with that?

(*Dr Shohet*) I do not, up to a point. At the moment we are actually surveying some companies and asking those sorts of questions, to what extent are the scientists you are employing well trained in the things you want them to work on? Most companies I think would recognise that in any form it is unlikely that a research student is going to have all the right skills which the company may want when it comes to doing research within that company, and there are all kinds of corporate reasons: styles of research is another

[Chairman *contd.*]

important aspect to consider. If the implication is that companies all expect perfectly trained scientists who can walk into their companies knowing precisely how to do that research, they are probably asking for too much.

1027. Would you say it is the small and medium sized companies which tend to think that way rather than the big ones?

(*Dr Shohet*) That may be the case because they would wish to get people on board as quickly as possible to get their research up and running.

Lord Dainton

1028. Would you agree that you can stand that argument on its head, and say that those people who come in and fit in perfectly will never change firms which need to be changed?

(*Prof Mellitt*) Indeed. This is an interesting area. There are undoubtedly some members of the CBI, if you button-hole them in a cocktail party or on the tube, who might say that, but there is a much larger proportion of CBI members who understand the products of our great universities in terms of teaching are individuals who are organised, who are numerate and literate and can apply themselves to problem-solving. Certainly in the larger companies that is very clearly understood and if one tracks the initial discipline of particular individuals with how they proceed in their career, there is very little correlation. I think it could well be an issue for the very small companies, as Simon discussed, but in practice the small companies are not looking for this level of specific excellence, they are looking for generalists.

Chairman

1029. The chairman being somebody who would solve all their problems, of course! The hand of the DTI in the White Paper is very clear and they do not deny they have played quite a big part.

(*Prof Mellitt*) They try to be influential.

1030. And they have been, clearly.

(*Prof Mellitt*) Yes, they have.

1031. Do you regard it as in any way paradoxical that the wind-up of the Advanced Technology Programme was more or less at the same time as the White Paper was established?

(*Prof Mellitt*) This is an issue we have discussed and Mr Lennard will respond.

(*Mr Lennard*) My Lord Chairman, yes, is the short answer. It seems an anomaly, first of all, to change 60 per cent on technology programmes and 40 per cent on technology transfer round the other way overnight, and I have not seen any justification for spending 60 per cent of their funding on technology transfer. I am the first to agree that we need to do more technology transfer in this country, but I think by, at a stroke, doing away with the Advanced Technology Programmes they really have thrown the baby out with the bath water.

1032. You may not have seen the justification but what do you think their excuse was?

(*Prof Mellitt*) It seems, my noble Lord Chairman, that is a question for the DTI.

1033. Well done! Thank you very much for coming.

(*Prof Mellitt*) Thank you very much, my Lord Chairman, noble lords, for taking our evidence.

A memorandum by Dr John Lackie is printed in HL Paper 82-I of Session 1992-93, p224.

Examination of witness

DR JOHN LACKIE, Director, Yamanouchi Research Institute, was called in and examined.

Chairman

1034. Dr Lackie, thank you very much for joining us this afternoon, and thank you for writing to us. You wrote to us—if I remember rightly—just before the White Paper appeared. Is it what you expected to see, more or less—or "hoped to see", perhaps I should say?

(*Dr Lackie*) It is difficult. I am not sure I know exactly what I expected to see from it. I think it was extremely good to see that science policy had raised its head as a serious political item. I think it is past time that science was considered more seriously. I liked the statements in it that science and universities were a very valuable resource and could contribute to wealth, but I had some quibbles about minor things in it. The thing I am worried about—and my own feeling about it was—that I am not sure that all the problems lie with academia. Too much, to my thinking, of the White Paper addressed the problems of what was wrong with the academic side of the academic/industry interface, and not enough addressed the question of what might be wrong with industry. That was, very much, my personal feeling on it. I should say that I have a certain bias. I have spent most of my career, so far, in academia and only three or four years ago did I move into industry—and Japanese industry at that.

1035. What was the meaning of the last few words you used? "... Japanese industry at that"?

A. I suppose the thing I would say is that the Japanese pharmaceutical company, for which I work, is very happy to make an investment in research in Britain and that I have seen very much as a vote of confidence in bio-medical science in Britain. If they are prepared to invest in it, I think that is a vote of confidence in our science. I wonder what it says about attitudes of industry in the United Kingdom, but that is, perhaps, being a little contentious.

1036. You are being completely consistent, at any rate, with what you wrote to us, which is something! The Government appears—as far as I can judge the White Paper before it is put into visible action—to want to push the basic research system more towards

[Chairman *contd.*]

wealth creation, application, or whatever you want to call it. You have been arguing all along that you would like university researchers to be doing speculative and exploratory work, that it is industry's job to do the rest; and you have just said that more or less. Do you really think the White Paper is trying to move in the wrong direction?

A. I think my feeling would be that the focus of attention has, perhaps, been unduly on the bit that can be manipulated easily, on academia and not sufficiently on the bit that probably needs kicking into action.

1037. To what extent do you think that? Was there a misunderstanding of the nature of the problem, or, on the other hand, a reflection of the inner power struggle that goes on in any government?

A. I do not think I am really qualified to comment on that.

Lord Dainton

1038. What do you think needs kicking into action?

A. My own feeling is, working in the pharmaceutical industry, that we have never had any great problem interacting with academic research. In fact, I would say we have an extremely good interface with the academic sector and have gone to considerable trouble to maintain that interface and to work on it. It is my impression that this is a peculiarity of one or two rather successful industries in the United Kingdom. I do not really know what is happening, but from the comments that are being made by the CBI and others, it seems that a greater proportion of other industries are not as good at interfacing with academia.

1039. But it is the easiest subject of all, of course, because in chemistry and allied subjects, what you do in university can be the same as what you do in industry, can it not? For example, the shaping of molecules to serve particular ends is the same whether it is done in the university or industry. Are you saying that when there is this shake-up there should not be exploitation outside the industry?

A. Certainly it has been said by people probably better qualified to make the statement than myself that other industries are less good at interacting with academia. I think it is also commonly said that the Japanese are particularly good at exploiting the fruits of academic research. Quite why that should be I do not know, but I do think there is definitely a problem in the United Kingdom. I think you are right in saying that the pharmaceutical and chemical industries have an easier job interfacing, but I do not think that allows us the luxury of not attempting to improve the interfacing with other industries.

1040. If that is the case, it does rather suggest that the emphasis is a little bit wrong in "Realising our potential". Perhaps the emphasis should have been on something where government gets into bed—like MITI and Monbisho—with industry and the universities as well. I ask this because you are from Yamanouchi!

A. I have to say that I do not know a great deal about the way in which the Japanese Foresight exercise operates. I have relatively little contact with the Japanese industry/academia linkage. I think, in fact, that this is an important feature of the way that a Japanese company has attempted its interfacing. It has taken a fairly hands-off approach to British science. It has not tried to do it the way a Japanese company might interface with Japanese science. It has said, "Let's do it a different way."

Lord Porter of Luddenham

1041. I would be very interested if you could say a little bit more about this because I am not clear whether we are talking about Japanese industry, British, or what. To use your phrase, as the Chairman did, "Japanese industry at that." I am still not clear of the implications of that, but let me ask quite simply, on the question of the wish and the ability of industry to liaise with basic research in other places, are the Japanese better and freer than the British?

A. They are certainly good at doing it. It is said—I do not know how true this is—that many academic scientists see more Japanese businessmen hammering on their door, than they see British businessmen hammering on their door. I should perhaps explain that I was recruited by a Japanese pharmaceutical company to set up a basic research unit in the United Kingdom, with the deliberate intention of accessing British expertise in bio-medical science and in drug discovery.

1042. Of course that is an area where the Japanese have a lot to learn from us. We are the leaders in pharmaceutical research. Now if the research was solid state, or something of that kind, it would not be quite the same.

A. That is undoubtedly true. I am trying to point out a lesson or a moral to be gained from this. The Japanese feel that they have something to learn so they set out to learn it. I would also say that on the Oxford Science Park, next to where we are located, Sharp have set up a research laboratory as well and they are not in drug discovery.

1043. When you say "they have set up" these are the industrialists themselves, the industrial companies, and not through MITI or anything?

A. No, as far as I understand, this has been set up purely by Sharp.

1044. Why do you think there is a different thrust there?

A. This is a loaded question, I suspect.

1045. We need to know.

A. One of the things that has impressed me are the attitudes—certainly in the company I work for—and the long-term view; the view they take of the necessity to invest in basic science with a realisation that the outcome will be a long way in the future. Maybe this is peculiar to the pharmaceutical industry, but I think the pharmaceutical industry in Britain has also been good at taking that long-term view of the importance of basic science.

Lord Chorley

1046. And the Japanese Stock Market does not seem to mind.

A. That appears to be the case and long may it continue!

[Lord Chorley *contd.*]

Lord Porter of Luddenham] I have my doubts about this.

Lord Tombs

1047. The Japanese Stock Market is an area of low returns and very high PEs and great patience, here we have had a history of high inflation, high interest rates and high concentration of capital, but I think the Japanese recognise the need to be aware in a way much of British industry does not recognise the need, as yet. That may stem from a history of fairly easy living in the past but I think it is developing. What I would like to ask Dr Lackie is whether he thinks the White Paper offers the opportunity for industry at large, particularly the areas which do not recognise the need for basic research, to have a voice? You have mentioned the pharmaceutical industry is closely related to universities but what about the areas of industry which are not closely related? Do you think the White Paper offers a convincing path for them?

A. I am not convinced that it does, but I have to say, not working in one of those industries, it is difficult for me to know what the barrier to interfacing with academia is. Working in an industry which has historically been and is at present extremely good at maintaining the interface with academia, it is difficult to understand quite where the barriers lie. So perhaps I am the wrong person to be asking that question of.

Chairman

1048. What do you think of the process whereby priorities are set for the science base by the research councils and others in this country? Do you think on the whole it is satisfactory? From what you said earlier on, I might deduce you did think it was satisfactory, because it stressed excellence rather than utility, but it is for you to answer the question, not for me on your behalf. Do you think it could be changed and, if so, how and to what extent?

A. I think you are right to take from what I say the inference that on the whole I am fairly comfortable with it. The thing I would say is that we do not know about the things which do not get funded, so it is a little difficult to know what has been missed. One of the comments which it occurred to me to make was that one of the things we should perhaps be very aware of is those things which get picked up by non-UK industries, not because we should attempt to stop that happening in any sense but to try and learn from what has gone on. I have had the comment made, "I tried to interest British industry in this and I could not raise any interest and now I am linked to a Japanese company." I do not think that is a terribly unusual statement. So on the question of how priorities are being decided, I think one of the informative things would be to know more about those things which are not funded and where opportunities have been missed, to see whether there is a way of avoiding that in the future.

1049. I do not want to push you too far into detail you may not be familiar with but there are two senses in which things may be missed. One is that there are 100 good applications and only money for 50, so only half get it, and in a sense therefore half have been missed. There is another sense in which you say, "This area is much more important than that area, we will fund that a lot more than some of the others, perhaps not fund some at all"; a deliberate leaving of things out. Which do you mean when you talk of things being missed out?

A. "Things which have been missed" in my statement are those where we have picked the wrong 50 per cent. Hindsight is very much better at determining that than foresight, to be honest. I think it is very difficult to actually say whether the right decisions have been made, the right priorities assigned. One of the things I would say is that it does seem to me that progress in science has usually been a consequence of development of techniques, and very often research on new technical developments in science is not really very sexy, so it does not attract the funding that other areas might. It is very clear that new techniques—the use of restriction enzymes, the use of an electron microscope, a whole range of things like that—have opened up whole new areas of science, and I think it is very important that we do not follow fashion too assiduously and forget the lone scientist who is pursuing the development of the technique which may in fact open up a whole new area of science. Very difficult to predict.

1050. This year's fashion is last year's urgency, is it not?

A. Yes. In a sense one of my feelings would be that one of our crucial resources is diversity of talent, and that is where I think the dual support system has been particularly valuable in allowing diversity which can be expanded rapidly. It is the argument for outbreeding if you like; it is the diversity of genes in the population which allows you to respond to change effectively, to use a very biological analogy. If we go for a highly inbred and highly successful science base, then if the game changes we will be in serious difficulty.

1051. So you welcome the fact Mr Waldegrave said that the transfer of funds from one side of the dual support system to the other, from the university funding councils to the research councils, will not go further?

A. I would be very sad indeed to see the dual support system fail.

Lord Porter of Luddenham

1052. How do you respond to the often heard statement that we are a small country and we are short of money, we cannot do everything and we have to select?

A. I can see the force of the argument. The concern in my mind is how good the selection process will ever be.

Lord Dainton

1053. But is it not also often the case that people of high quality who come through this process are very adaptable and can bend their minds to new problems, so the key at the end of the day is good people, well educated, who are prepared to change by new challenges?

A. I think that is absolutely true. If I can follow up a point made earlier about compartmentalisation,

[Lord Dainton *contd.*]

there is a fallacy in supposing that if you train a scientist in one discipline he cannot change areas. I think the value of the training is much more in general skills of approaching problems and much less in the factual content of a particular field. I think subject specialisation is a misapprehension. One of the consequences of that misapprehension is a failure, I think, in this country to use scientists much more broadly in matters not necessarily relating to science.

Lord Porter of Luddenham

1054. But this does create a difficulty, does it not? What are you going to do if you have a very good scientist whom you would like to support as a scientist but he is in one of these fields that this poor country cannot afford to support? Are you going to turn the screws on him and make him change to another field?

A. I do not think you can avoid the necessity of some hard decisions. I think there have to be those hard decisions. It is a problem which is faced all the time in industry. There are always more good projects than projects which you can support.

1055. Of course. But you would hang on to the man?

A. Yes.

1056. Even if you had to support a field which was not on the list? Or would you push the man into another field?

A. Perhaps I would allow him to go abroad for a few years and make sure I could get him back. I do not know.

Lord Dainton

1057. That brings us to another point in the White Paper which I happen to think is rather important, which I would like your views on; is the "getting back" business related to career prospects? What is your attitude to what is said there? Do you think that is a factor which really in a sense answers part of prioritising science, namely if you get good people back, they will in a sense, since they are very intelligent, be the best guidance system we could have?

A. I would completely agree with the general line that good science is done by good scientists, and therefore I guess I would agree with you entirely that the thing to do is to make sure we can get back the people we would like to attract back.

1058. So, for example, do you foresee the other things being referred to, like for example, a fourth year or in some universities a fifth year MSc, as a good move forward?

A. I have to say that one of the features of the White Paper I was less than happy with was the MSc proposals because it seemed to me, in my mind, not to be necessarily the correct solution to the problem of providing better training. That is a very personal view.

1059. Is that because we are becoming more specialised in that?

A. One of the concerns I would have is that somebody who does an MSc, but does not go on to do a PhD, has no added value as far as recruitment in industry. I think there is much merit in the idea of extending the undergraduate teaching course so that the honours school has sufficient space of time for students to develop the skills that they are supposed to be developing. I personally would favour much more a two-year first/"ordinary" degree, if you like, and a two-year specialist honours course for those who feel moved to do that, and let others move into other areas and broaden themselves. It is clear that much of the teaching done in the final honours year is not really ideally suited for a proportion of the students going through that system. I speak as an ex-academic in that context.

Chairman

1060. Some of the Heads of Research Councils—not all—choose to interpret the White Paper as allowing them (or encouraging them) to use their funds wherever they see good research being done. Mark Richmond, for instance, would be quite willing, under the White Paper, to divert some of his funds into industrial research laboratories (or whatever) away from the traditional science base of universities. Do you think it would be a good idea if good research was funded wherever it can be found, or do you think Research Councils should continue to do as they have done in the past and support good research in the universities and in their laboratories, given that the amount of money is unlikely to be increased whichever they do?

A. I think that I would go back to my earlier point and say certainly, as far as we are concerned, the universities should be providing a pool of speculative exploratory work, from which we will select things that we will take on into the more goal-orientated direction. So I think, on the whole, that I would feel that any weakening of the university sector was to be avoided. Much as I would like additional funding put into my laboratory, I do not think it would be right for the Research Councils to put money outside of the academic sector into industrial laboratories, as such.

1061. Thank you very much for joining us this afternoon.

A. May I just say, as a final comment, that I have been fairly outspoken. I am speaking as an individual.

Lord Dainton

1062. So are we all!

A. On the other hand, I did discuss the letter that I sent you, in the first place, with our Senior Director of Research and Development in Japan, who is effectively number 3 in the company, and his comment was that he agreed whole-heartedly with the sentiments.

Chairman] Thank you very much.

WEDNESDAY 24 NOVEMBER 1993

Present:

Dainton, L.	Selborne, E.
Flowers, L. (Chairman)	Tombs, L.

Memorandum by the Royal Society of Edinburgh

A: INTRODUCTION

1. The Royal Society of Edinburgh (RSE) welcomes the opportunity to submit evidence to Sub-Committee 1 for its review of the "Priorities for the Science Base". Although there is a dominant interest within the RSE Fellowship on matters affecting science and technology, we should like to emphasise that the RSE's interests embrace all aspects of learning. RSE Fellows received the list of questions posed by the Sub-Committee. The evidence now submitted, with the authority of the Council of the RSE, reflects the views distilled from the many responses received from the full spectrum of the Fellowship.

2. We are most grateful for the extension granted to the RSE to submit evidence, because we felt it would be more helpful to respond to the questions posed by the Sub-Committee after we had the opportunity to consider the recent White Paper "Realising our Potential". This important and timely White Paper has overtaken some of the original questions, as well as raising other issues which we believe are relevant to the remit of the Sub-Committee.

3. The RSE contributes to the Science Base in Scotland by:

- providing about 20 post-doctoral Research Fellowships, mainly in Science and Technology, in Scottish HEIs and Research Institutes (now financed mainly from non-Governmental sources);
- organising regular conferences, symposia, seminars and workshops, with an emphasis on interdisciplinary approaches; and
- publishing research journals in three scientific disciplines.

The subject areas for some of the post-doctoral Research Fellowships are specified by the donors, but in all cases, the choice of candidates lies solely with the RSE. There is intense competition for these Fellowships and appointments are made on the basis of individual merit and potential. We feel that there is a real need for greater opportunities to support outstanding individuals, rather than topics. We are actively seeking further funding to develop our contribution to the Science Base in Scotland.

B: THE SCOTTISH SCENE

1. The traditional areas of excellence in science in Scotland are reflected in the subject areas covered by the RSE's journals, namely:

- Biological, biomedical and life sciences;
- Earth and environmental sciences; and
- Mathematics.

2. More recently emerging areas of excellence include: electronics, computer science, pharmaceutics, offshore engineering and social science/management science.

3. There is little perception amongst leading researchers in Scotland that "Scottish science" is in any significant way different from that conducted by leading researchers elsewhere in the UK or internationally. Indeed, there is a strong feeling in Scotland that our scientific research must continue to be judged by UK and international standards. For that reason, we do not advocate the break-up of the present UK structures for the Research Councils into national Research Councils to match those of the Funding Councils. However, the existence of different territorial structures for the different parts of the dual support system, strengthens the need for even more effective mechanisms for co-operation and co-ordination beween the Research Councils and the Funding Councils. We therefore welcome and see an important role for the Chief Scientific Adviser's Co-ordinating Committee. We also regard it as important that there is a fair balance of representation, both by discipline and geography, in the composition of the Research Councils and advisory bodies to ensure that they reflect the strengths of all parts of the UK.

4. It has not proven easy to obtain statistical data on the scale and composition of funding for the Science Base in Scotland. The reasons for this need to be addressed by Government, because the absence of consistent, up-to-date data will make it even more difficult to assess the impact in Scotland of changes arising from the White Paper.

Provisional analysis of various UK and Scottish statistical sources, suggest about £400 million per annum is being spent on the Science Base in Scotland. Further analysis is being undertaken for an RSE symposium in April 1993 on underpinning the Scottish Science Base, and the results of this will be made available to the Sub-Committee.

The main sources of funding for the Science Base in Scotland are:

(a) **SHEFC,** which provides £97 million (in 1993-94) to the 12 Scottish HEIs specifically for research.

(b) **Research Councils,** which provide about £45 million of specific project grants, plus other funds, to Scottish HEIs, in addition to the costs of those few Research Council institutions located in Scotland, most notably the Royal Observatory, Edinburgh; the Scottish Association for Marine Science (Oban) and various MRC units.

(c) **Charities,** which provide about £35 million to Scottish HEIs, especially for work in the biomedical fields.

(d) **Government Departments,** and related public agencies, which provide about £23 million to Scottish HEIs. They also support various Research Institutes based in Scotland, mainly concerned with national and international issues in the biological, geological, environmental and engineering sciences. These include the Rowett, the Torry and the Macaulay Institutes (all in Aberdeen); the Scottish Crop Research Institute (Dundee); British Geological Survey, Forestry Commission and National Engineering Laboratory (East Kilbride). The Scottish Office supports the Scottish Agricultural Colleges and the Royal Botanic Garden, Edinburgh.

(e) **Industry and Commerce,** which provide about £21 million to Scottish HEIs for collaborative projects and support.

(f) **EC,** which provides about £12 million to Scottish HEIs.

Scotland has about 9 per cent of the UK population, but, traditionally, the Scottish University system has been a comparatively larger fraction of the British system. It now has about 14 per cent of UK staff and students and receives 14 per cent of total income and research income. Relative to the size of its academic base, Scotland does not receive any disproportionate share of UK funds for research. However, there would appear to be a long term trend towards even greater expansion of the University system south of the border, which means that, in **relative** terms, Scotland is likely to experience a declining share of UK resources for research and higher education.

A recent study for the Scottish Foundation for Economic Research indicated that, in 1989, total funding for R&D in Scotland was only between 5.4 per cent and 6.1 per cent of that for the UK. Also, over 50 per cent of Scottish **industrial** R&D was concentrated in electronics and electrical engineering.

5. A notable feature of the Scottish scene is the recognition already given to the importance of innovation and technology transfer. This is seen as vital to increasing the competitiveness of Scottish companies and is largely achieved through local networks and contacts, supported by the Scottish Office Industry Department, Scottish Enterprise and Local Enterprise Councils. The changes envisaged in the White Paper for greater devolution of these responsibilities to Scotland are welcome if, as yet, not quite clear.

There may be benefit in developing specific research areas in close geographical proximity to particular industrial sectors, as an example of refinement of regional policy and of attracting inward investment, including that for research. The RSE could be of assistance to Government and the Enterprise Agencies in considering the scope for such policies in Scotland.

C. Specific Questions

1. *What is public expenditure on the Science Base for?*

Public expenditure on the Science Base serves a number of purposes among which we regard the most important as:

(a) to advance scientific understanding at all levels for the benefit of mankind generally and to allow the exploitation of accumulated and new-found knowledge;

(b) to train future generations in science and technology to serve the needs of society and existing and future industry;

(c) to apply scientific and technical information to existing and future problems to enable the UK to compete as a leading industrial nation; and

(d) to contribute to international projects where this is required.

Such support recognises the social and cultural, as well as economic, benefits that stem from R&D which is essential for underpinning both modern industrial society and national economic development. We believe that public expenditure on the Science Base is also essential in support of modern industry, and that the purposes defined above should be met by the Universities and other research groups in the science and engineering research base interacting closely with industry. This should take place against a background of well-defined overarching strategies, improved communication and a raised level of mutual understanding. It should never, however, be regarded as a substitute for the large amount of R&D that must continue to be done in industry itself and which is vital to successful wealth creation.

In this context we note the emphasis on wealth creation in the recent White Paper "Realising our Potential: A Strategy for Science, Engineering and Technology", and we support the notion of the "Technology Foresight" exercise described therein.

2. *What are the objectives and priorities of the various funding agencies within Government? Research Councils, HEFCs, other departments. Are they related? Is an overview required and do the existing structures (ABRC, ACOST, OST) provide it?*

We would summarise the objectives of the various public funding agencies, to date, as follows:

Research Councils—to support **project** research of the highest quality in all fields of endeavour;

HEFCs—to support **basic and strategic** research (Frascati definitions) in HEIs; and

Other Departments—to support **specific** research projects of relevance to their missions.

Each should have built upon the other, but although the objectives and priorities have been related, there has been unnecessary competition in some areas and some obscurity in certain respects. There is strong opinion that we have not had an adequate provision for overview and selection of priorities and strategies in the UK, in contrast to some of our major and successful competitors overseas, whose practices in this respect bear close examination.

This is recognised in the White Paper. The **Technology Foresight** programme, with its emphasis on panels of experts drawn from a wide range of constituencies and age groups, the **Council for Science and Technology** and the definition of **Mission Statements** for the Research Councils are all major steps forward in this context and we welcome them.

In the restructuring of the Research Councils it is important that subjects at the interfaces between disciplines such as chemistry and biology, and the physical-social science interface, are not overlooked, and that the allocation of responsibilities does not cause artificial boundaries. Whilst duplication should be avoided whenever possible, it would be better to err in this direction rather than to create gaps. It is important that selected funding for research is continued and that good scientists and technologists and good departments are properly funded.

3. *What are the relationships connecting Government funding of the Science Base, funding by industry and charities, and overseas funding (particularly from the EC)? Various people are "paying the piper": are they calling different or incompatible tunes, and if so, is this a bad thing?*

Science and technology policy and strategy must be closely related to, and interwoven with, economic and industrial strategy. It is essential to maintain a balance between curiosity-driven research and customer-driven research. It is not a question of science versus industry, or excellence versus mediocrity. What is needed is a continuum spanning fundamental, strategic and contract research, and development and exploitation through companies. OST, through its influence and policy, must endeavour to motivate all these and sustain the correct balance between them.

As Government contributes to the funding of the Science Base through a wide variety of its Departments and related agencies, it is also important for OST to achieve better co-ordination and consistency between them and with the other bodies contributing to the Science Base.

Obtaining a comprehensive overview of what is being done by industry in the UK is becoming more difficult because of commercial confidentiality and the increasingly multi-national character of industry. In addition, it is not clear to us how an accurate overview of charity funding is being maintained by Government. The RSE is a charity receiving public and private funds for research, but we are only required to inform Government about the research we support from public funds. Charities often take the view that they should not support activities which they believe should be funded publicly.

We do not believe it is necessary, nor indeed desirable, for all the funding bodies to be calling the same tune. In an area as diverse as the Science Base it is inevitable, and no bad thing, that in the provision of funding a number of different tunes are being played by different pipers. However, this does not remove the need for more thinking and planning at national level to provide an overview and intelligent selection of priorities and strategies.

It is also essential for the various contributors to the Science Base to recognise the knock-on effects which changes in their own priorities for funding will have overall. This is particularly important for the dual-support system, which requires balanced inputs from different public sources. We are pleased to note the commitment given in the White Paper to maintaining the dual-support system, which has the potential, provided it is properly funded, to enable institutions to undertake speculative research which might not otherwise attract funding from Research Councils or other sources. In technological areas, Government-funded research programmes in HEIs can complement an industry's directly funded or co-funded projects. Through close collaboration involving say, a company, a Research Council or Foundation, and a university, it can be ensured that proposals meet the overall objectives of all the participating bodies and provide excellent value for money.

There are mixed feelings about EC funding, both in the mechanisms used by the EC for its distribution and by the way it is accounted for by the UK Treasury. Perhaps there should be more responsive mode funding from the EC. Applying for, obtaining and administering EC grants should not demand, as at present, so much paperwork. More co-ordinated advice and guidance from Government to industry about EC funded programmes is urged, to ensure a higher share of the funds coming to the UK and better exploitation of the outcome. In considering British relationships with Europe and EC budgets, we appear to be at a serious disadvantage compared with our European partners and other competitors, through not having, as they do, a coherent Government/Industry strategy and policy which allows industry to derive maximum benefit. For example the French, Germans and others see their work in Europe as an extension of national industrial policy. This highlights the issue of the role of Government in R&D and its relationship with industry.

4. *What information and advice is needed by those who are setting priorities? How do they know what is going on in low priority fields? How do they track developments overseas?*

There is undoubtedly a need in the UK to improve communication and the level of mutual understanding between the science and engineering base on the one hand, and industry and other research users on the other, by making each more aware and responsive or receptive to the work and problems of the other. This will provide the framework for priority setting which has to be done professionally and at top level as in other technologically advanced countries. The scheme now set out in the White Paper in the remit of the Technology Foresight Steering Group and its relationship with its panels of experts and the new Council for Science and Technology appears commendable.

In this context, it will be necessary to establish lists of leading academic and industrial scientists who can be consulted about priority fields of scientific research and the enabling underpinning disciplines. These scientists will know what is going on in currently-rated high or low priority fields and also what is happening abroad. Government, industry and academe will be working together to provide the framework for priority decisions in major scientific and technological areas against a background of potential benefits in wider markets or product applications of new technologies and information from academic institutions on feasibility, timescales, risks, uncertainties and costs of conducting research in these areas. International "state of the art" will also be kept constantly under review and weighed into the strategy debate. Databases tracking research results, publications and developments both at home and overseas will assist in the process of concentrating limited resources in appropriate areas of research. (Appropriate institutions and information centres already exist in many countries, particularly in Western Europe, and these would welcome the development of communication on such matters with a single co-ordinating body in the UK.) British reluctance to recognise the potential and advantages of adopting superior foreign developments must be minimised in order to assist in identifying R&D priorities and optimising related expenditure.

Equally important, in our view, is the need to encourage greater mobility and exchange of people at all levels throughout the different sectors of academe, science, industry and Government. This would enhance the formal and informal channels of communication and allow greater understanding of needs and expectations on all sides. Mobility of graduates and postgraduates into and out of industry is an important form of technology transfer. To achieve greater mobility will require specific measures of positive encouragement from all employers and Government to help overcome the existing inertia and restrictive structures.

The means by which the Technology Foresight process can take account of the needs and interests of industrial sectors in which SMEs predominate has yet to be developed. Similarly, attention needs to be given to the means by which the potential benefits which will flow from the new emphasis of science policy will be made available to firms. RSE is considering whether it could play a part in developing appropriate information networks.

5. *How do charities and companies which fund research set and implement priorities? How is it done overseas? Are there lessons here for the Government?*

Charities tend to operate in fairly well defined fields, either as specified by the terms of the original benefactions or founders, or in accordance with their specific charitable objectives, which normally reflect the need to deliver "public good or benefit" from such support. Many charities adopt a medium to long term view in the timescales required to achieve these benefits. The main lessons to be learnt from this are the advantages of sustained effort and support in specific fields, as it is necessary to provide stability and continuity in order to build up and maintain the expertise required to tackle many of the basic scientific issues relevant to the interests of these charities.

In companies it is likely that all priorities would meet defined business objectives. Short to medium term applied R&D would normally be justified on a cost-benefit basis enabling a ranking of projects; longer term research projects would be considered against technological trends important to the company's strategic objectives. R&D projects are usually reviewed annually by a high level review panel against agreed objectives, targets, and overall strategy.

With regard to the implementation of priorities, Government would be well advised to examine the close links and co-operation which exists between industry, scientific institutes and Government in other countries, notably Germany, USA and Japan, and the ways in which they set their priorities for the Science Base. This would lead to a stated definition of national strategic and policy objectives in relation to the Science Base, against which Government-supported research programmes could be driven and reviewed. The priorities would be set in the light of research being done both at home and overseas. The Technology Foresight Exercise and the Forward Look proposals of the White Paper appear to have addressed these suggestions to a substantial degree.

6. *What are the objectives and priorities of the HEFCs in funding university research through block grants, and who is setting them and on what basis?*

The objectives and priorities of the HEFCs in funding research are laid down in their mission statements. We understand that the Funding Councils have provided evidence on these issues.

7. *How is the University's block grant distributed between departments and on what basis?*

As the RSE does not take part or seek to influence internal university allocations, we feel it would not be appropriate for us to comment here.

8. *What are the impacts on priority setting of:*

(a) **The abolition of the binary divide.** It is too early to judge the effect of the abolition of the binary divide on research priorities. Provided quality of research remains the primary factor, and not an institution's previous history, then the abolition of the binary line should have a neutral effect. Whilst we support competition and a more open system for research funding, it will be important to ensure that the present strengths in applied research at many of the newer universities are recognised and encouraged.

(b) **The regionalisation of funding.** It is also too early to assess the effect which regionalisation of the Funding Councils will have. If the allocation of funding within the universities remains largely an internal matter, we would not expect regionalisation, per se, to have any significant effect on priorities. Indeed, such effects as may later be observed are likely to derive from the results of the recent Research Assessment Exercise, which will tend to reinforce support towards already strong areas and centres. Regionalisation of funding may, however, allow institutions to serve better special local needs or support special environmental needs or facilities. This is reasonable, provided that quality criteria are maintained.

(c) **The shift of emphasis from core funding to project funding involved in the transfer of £150m p.a. from the HEFCs to the Research Councils.** The transfer of funding from HEFCs to the Research Councils should, of itself, have a neutral effect, provided the institutions have in the past been providing correctly the necessary supporting infrastructure for holders of Research Council grants and the funding is correctly spent on supporting projects that the Councils had previously funded. However, we understand that some of the extra Research Council money may have been used to fund new projects, to the detriment of previously funded projects which then had to receive supplementary internal support from their own institutions. We understand this problem was transitional and now seems to have been largely corrected.

(d) **Formula funding, research rating and moves towards an R-T-X model.** Increasingly, and perhaps inevitably, selective research funding by the HEFCs will lead to an R-T-X situation, in fact, if not by intention, or by explicit "label".

9. *The Research Councils have explicit missions. How are these translated into priorities, by whom and on what basis?*

It is our view that the explicit mission statements now defined by the Research Councils will translate readily into priorities and the membership of the Councils and Boards (to which we as a Society would hope to nominate) would ensure that the expertise is available to set priorities. This system should work, provided the membership is drawn widely from all parts of the UK and that the Research Councils do not become entirely mission oriented; this could diminish the quality of the research funded.

10. *How are the competing priorities of the different Research Councils (and the Royal Sociey and the RAEng) reconciled within the limits of the Science Budget?*

This question has been overtaken by the publication of the White Paper which has re-defined the boundaries of the Research Councils and has recognised also the special roles of the learned societies and other groups. All will be aware of the outcomes of the Foresight Exercise, the Forward Look and the deliberations of the Council for Science and Technology, and will take these into account in setting their own priorities and programmes.

The creation of new Research Councils will need to be accompanied by re-allocation of budgets. As this transfer process itself should not be done in such a way as would advantage or disadvantage existing programmes, we welcome the transitional approach adopted by Sir David Phillips' group, which is based on transfer of existing levels of funding for each defined subject area into the new Councils. It will then, of course, be necessary for the Councils, in the light of the priorities established by the new advisory arrangements, to allocate the resources given to each. As the science budget expands, it should be focused more on the underpinning of science for profitable and new industries as happens in Germany, the USA and Japan, as discussed previously (5).

11. *Are the priorities of the Research Councils skewed by the boundaries between the Councils' remits, by the existence of Research Council institutes, by international obligations to support "big science", or by anything else?*

International obligations to "big science" have impacted on all sectors. Our general view is that "big science" has skewed funding in its favour and has deprived "small science" of the funding continuity it deserves. At the same time it has undermined the profile "small science" deserves in relation to its contribution to the UK's balance of payments. However, it also needs to be recognised that the domestic budget for some "big science" areas has also declined significantly, largely as a result of the subscriptions to overseas facilities. The new arrangements referred to in 10 should lead to improvements in balance.

12. *How is the money transferred from the UFC to the Research Councils being spent?*

We have dealt with this in response to Question 8c.

Examination of witnesses

DR T L T JOHNSTON, President, SIR KENNETH ALEXANDER, Vice President, PROFESSOR M A JEEVES, former Vice President, PROFESSOR F T LAST, Programme Convenor and PROFESSOR D J WALLACE, Fellow, Royal Society of Edinburgh, were called in and examined in the Society's rooms in Edinburgh.

Chairman

1063. Good morning, President. Thank you and your colleagues very much for attending us this morning and allowing us to convert this room into the House of Lords for an hour or so. I would like to thank you formally, if I may, for all the arrangements that you have made and for the very kind hospitality you showed us last night.

(*Dr Johnston*) My Lord Chairman, thank you very much for your kind words. We are, of course, delighted that your Sub-Committee has come here and we know, Sir, you have been here before and we hope very much that this will become a habit when there are important issues which have national and international perspectives. May I begin by apologising for the absence of Professor David Tedford, who masterminded the paper that the Society sent. He was struck down by the gastric flu that is going about so we really are very sorry about that.

1064. Our best wishes to him.

(*Dr Johnston*) We have been in touch with him and if there are matters today on which you feel it would be helpful to have the author of the paper elaborate we can certainly arrange for him at pretty short notice to put in a paper to your Clerk.

1065. Thank you.

(*Dr Johnston*) On the subject this morning we would certainly like, Sir, to cover the "Scottish dimension". We hope that we can also tease out some of the issues relating to Technology Foresight, technology transfer perhaps being part of that. We would equally like to say something about the dual support system which we think is germane, and some of my colleagues who are still currently active in academic life have some points they would very much like to discuss with you about the issue of manpower in the system. A few points about the Scottish dimension first of all, my Lord Chairman. Scotland, as you know, is a net exporter of education and we see no particular reason to change that; but we are also part of the United Kingdom system. Although the Scottish universities are now funded through the Scottish Office we see no case whatsoever for having separate Research Councils. One of the questions that the Clerk put to us was whether we might in a sense try to sneak in research preferences for Scotland on some other points that were being made. I think the issue there is that we are very happy indeed that some of the research institutes which, if you like, belong naturally to the Scottish habitat, such as some of the marine research stations, are based in Scotland and that they are funded through the Scottish Office; but that is not the same as saying we want a separate Research Council for Scotland at all. You may wish to raise with us the phenomenon that there is less industrial research and development spend in Scotland than is true in the United Kingdom nationally. That is an element of the Scottish dimension which does concern us and we are actively in touch with agencies like Scottish Enterprise about this. We are having a meeting next week with Scottish Enterprise very much to take forward the theme that is central to your concerns today, namely the White Paper and the science and technology base. I think I will stop at that point, Chairman, since I may have opened a big can of worms on a number of topics.

1066. You say Scottish industrial R&D is less than that of the United Kingdom. You might have said

[Chairman *contd.*]

"even less" than that of the United Kingdom which is low in any case.

(*Dr Johnston*) I think one of the reasons for that is that we do have a fairly small number of really large companies in Scotland which are running big research programmes. If one goes back over the years the Scottish Council of Development and Industry, with which Sir Kenneth was very actively involved, has been seeking very hard to preach the importance, in the context of importing industry into Scotland, of ensuring that research and development funds come through for that. So there is a recognition of the problem but I would still say we are not happy about the position.

Lord Dainton

1067. Are these figures you referred to as a percentage of turnover or as a percentage of Scottish national GDP, as it were? They could be quite different.

(*Dr Johnston*) Yes, quite. I think the figures you have actually got, my Lord, are based on the proportion of research and development spend which is funded by industry in Scotland as against that which is publicly funded.

1068. I see, yes. Another interpretation of that could be that you are over generously publicly funded. Do you know which it is by any chance because I would be interested to know?

(*Prof Wallace*) Can I make a comment on that? I would not have answered Yes to that question. There is a natural consequence of the fact that Scotland has been a net exporter of education which means per head of population there is more educational activity at the Higher Education level and, associated with that, more research. So that might be one of the factors in the relatively lower industry figures. I support a feeling that there has been large investment in locating in Scotland but it has been of industries which are more producing and do not on the whole bring large research establishments with them.

1069. Although you do make the point somewhere about the development of electronic and electrical engineering in recent years?

(*Prof Wallace*) Yes, there are very large establishments for high-tech production and state-of-the-art electronic equipment, for example Motorola, SUN, DEC and Hewlett Packard, but the relevant amount of research activity associated with this is, I believe, rather small.

Chairman

1070. Scottish Enterprise, which used to be the Scottish Development Agency, is something we have heard about of course and have had some contact with, but to what extent does it play a part in what the science base does?

(*Sir Kenneth Alexander*) My Lord Chairman, I think the first thing to be said about Scottish Enterprise is that it is still finding its feet and the forthcoming meeting to which our President referred will I hope help it to find its feet. It did produce, after pressure from the Secretary of State, which was rather interesting, a report on the role it could play in encouraging innovation in Scotland about a year ago. Since then the line they have emphasised is that they think that whatever they do must be what they call "demand led", that is coming from the customer side, from the industry side rather than from the science base side. They do not expect the science base to be able to close that gap between industry and the science base; they expect somehow or other to push industry towards the science base. That is the approach which they are taking and I think that it is right. I think that there is a woeful gap there and a substantial lack of interest in technology transfer, far less in direct connection with the science base, amongst Scottish industry. Part of that explanation is scale, the fact that although we have some very large companies we do not have a large number of large companies and I think academics find that it is easier very often to make connections with the people who are driving science in the large companies in the south than people here in Scotland. Very often United Kingdom companies have their 'science brain' in the south and not in Scotland and that creates a problem for the science base in Scotland. I think Scottish Enterprise are correct to recognise not only what one might almost call a lack of interest but also the incapacity of many medium-sized, not to mention small-sized, Scottish companies to take advantage of what science has to offer. We intend to tackle that quite actively. There is one scheme in operation at the moment; STRIDE (Science and Technology for Regional Innovation and Development). It is a European Union scheme that Scottish Enterprise has supported, involving ten or twelve companies in Scotland to whom recently redundant or retired senior people from technology-based companies are attached to help improve their capacity to respond to technological opportunities. As I say, that is a European policy which means that the money has partly come from the Commission and partly from the Scottish Office but it has had, according to what I have heard, quite an impact in these companies. I think we could do with more of that.

(*Dr Johnston*) Recently Scottish Enterprise published this report "Improving the Business Birth Rate; a Strategy for Scotland" which is based on an analysis of the rate of company formation in Scotland. That was found to be low, therefore they are saying, "We must create more new indigenous businesses." Whilst it is early days, the thing that worries us about such a scheme is that they are not seeing the role of the science base as explicit except in the form of small spin-off companies from higher education. We would like to think that once this show gets on the road there will be much more of a dialogue and an attempt to feed across from the science base to the network that they are seeking to establish. I think otherwise it could just be another of these grand schemes that dies a death.

1071. This is very helpful and is getting us round very close to one of the main pillars of the White Paper, namely the partnership between the universities, industry and government on the one hand and the specific technology transfer programme on the other. I wonder whether you would like to say a few words on how you would like to see that operating in Scotland. I presume that it would be part

[Chairman *contd.*]

of the general United Kingdom effort but you will no doubt have local arrangements in any case?

(*Dr Johnston*) We would certainly want to see the Society as having a role in this from the point of view of advice on the recruitment of people to the various sectors and groups that are to do the brain-storming and visionary things, and we are available to do that. We would certainly also wish to see Scottish industrialists positively wanting to become involved and we will be contacting the CBI, one of whose members is coming here next week, about that kind of thing. We assume when it comes to what I will call the "peer review" component in this that the existing arrangements will continue because in Scotland we have no complaints whatsoever about the way in which the academic community has drawn on Scottish academics for the purposes of assessing research proposals. I think we have certainly done well—I do not even want to use the term "fair share"—and I think the potential Scottish contribution has been well recognised. David Wallace, who has been, and is, very heavily involved with research councils, may want to elaborate on that point.

(*Prof Wallace*) If we are focusing on Foresight particularly then I would say I am comfortable with the idea that the government should be intending to get some idea of what the future might hold in terms of opportunities in technology. There are very positive benefits independent in some senses of the specific suggestions which come up. For example, it will help and encourage industries to be more outward looking and it will help in networking amongst industries. I think these generic benefits are identified by the Foresight team. There are barriers to be overcome. The two pitfalls are that there is a lost opportunity in industrialists actually undertaking work in the networking; it will cost them time and that must be recognised. Secondly if one does go down the wrong direction it really is counter-productive. I feel positive about the Foresight activity from a global strategic point of view. Where I become concerned on Foresight and wealth creation is if one tries to bring it down to the detailed level, for example, of which particular grants are going to be funded in a particular line. Would you wish me to explore that?

1072. I do not think so, not just now, because I think we are trying to get an overview. The Technology Foresight programme is supposed to be generated bottom up, where we are all supposed to develop a vision of the future and then somehow or other in a self-correcting fashion grope towards it but on the other hand it is quite clear that government departments, DTI especially, see it as a top-down mechanism controlling the funds. These two things are not necessarily consistent with each other because of timescales. I just wondered whether you had any comments about that.

(*Dr Johnston*) Can I make two points myself and then I will ask my colleagues to come in. I have a slight worry that we have been round these houses before under a different name, all the stuff about sector working parties in the 1970s when "Neddy" was going full blast. My worry about them is not so much what happens within them but what happens across the frontiers of those sectoral working parties, these strategic groups, that are set up. I would be very worried if we did not have a way of trying to look across technologies. The other point that I would make is that it clearly is going to require an enormous input from top industrialists. I doubt very much whether one can really expect them to give a lot of time to this exercise, and it therefore may well turn out to be an activity which is run by administrators rather than being fed strongly from the industrial side. That is a personal view.

(*Prof Jeeves*) My Lord Chairman, I have a slight concern that Technology Foresight might become synonymous with science foresight. It is not clear to me at all that these two are necessarily synonymous.

1073. Especially if the industrialists do not play a proper part.

(*Prof Jeeves*) Indeed, and therefore those responsible for setting the pace of technology foresight will be, according to their brief, primarily concerned with technology and, although it is some years since I was a member of the SERC, I think I would be very concerned if I felt that outwith the Council there were very strong pressures telling us which way we had to go with what I would regard as fundamental science. Therefore, I have a concern that it may set directions for a longish period which I think most of us close to science know is not easy to do because things change very quickly, so that does concern me.

Lord Dainton

1074. If one were devil's advocate in this matter you would be inclined to think that Technology Foresight was there possibly because the basic assumption was that scientists were not interested in seeing the application of their work but that has not been my experience and I would be very interested to know whether you share my view that scientists are in fact very keen to see their work applied and what they really need to do in order to get this interface really working is to gain their cooperation by convincing them simply that this is needed and they will go for it. It used to be the case; I do not know whether it still is.

(*Prof Jeeves*) Yes, I would share that view that although they do not have the applications at the top of their minds most of them these days have them very close to the top, whether it is on the SERC or the MRC, which I was also involved with for some time. It does seem to me that there are immediate applied problems that they have in mind although they were working at a basic level. I am thinking in terms of the MRC. There are problems which we know concern the country a great deal at the moment with the aged—my own area is brain research—for example Alzheimer's and Parkinson's. The MRC is very concerned about this. It is pure science but it has very important spin-offs. You have talked, my Lord Chairman, about wealth creation, but what I think is equally important, but I have not seen mentioned anywhere, is what I would call wealth conservation and by that I mean that the wealth that the nation is producing can so easily get eaten up in large amounts by the necessity, for example, of health care required later down the line. I think the US government has

[Lord Dainton *contd.*]

taken a much more serious view of this. You will remember that in 1989 the US Senate declared the 1990s the "Decade of the Brain" because they believed that with 50 million of their population suffering from various diseases related to the brain this was going to become an important drain on national resources and therefore they have put large amounts of money into this. This seems to me to be an aspect of wealth. It is one thing to create wealth but if we are going to conserve what we create we must bear in mind these other aspects. This is where it seems to me that untrammelled basic science is crucial.

Chairman

1075. If some clear pattern of what the nation regards as desirable should emerge from the Technology Foresight programme, clearer than it has been in the past, do you think the science base would in some sense follow that?

(*Prof Jeeves*) Well, I think there is a worry that they might but I have sufficient confidence in working scientists that they would make their views known very strongly if they felt that the direction that was being put forward was not one which was the right direction for basic science to be going at that time. In other words if it was overly influenced by the technological aspect rather than the pure science aspect I hope there would be sufficient voices to put a brake on it because it would worry me enormously if that was not the case. I think once you set a programme in train it might take some time to turn it round again.

Lord Dainton

1076. One might be able to say, and I would be interested in your comments on this, that whilst some people could set the objectives the feasibility of getting to them must lie further back and therefore would you agree it is necessary that those who are setting the objectives for Technology Foresight, if you like, should only do so after they have taken some consideration from those people who think what is feasible?

(*Prof Jeeves*) I would agree entirely. I think feasibility can only be judged by the scientists who are at the coal face at that time and not by those who are further away. I think it should be a process of consultation whereas the general direction of Technology Foresight seems to be that they should then consult, so to speak, with the working scientists to ask which of these look as if they are feasible in the foreseeable future?

(*Dr Johnston*) My Lord Chairman, the point I wanted to make is that there is no clear statement about timescales in the White Paper with regard to how we deliver things in the foreseeable future. If one thinks, to take an example, of a new pharmaceutical product one is talking of ten years from beginning to market place, and I think there is a grave danger that the government may expect quick pay-offs from Technology Foresight whereas if they are meaningful at all we must be thinking of ten, 15 or 20 years in the delivery process. Equally, another missing element is that there is practically nothing, apart from the statement of mission, about the importance of the financial community becoming involved. Everyone round this table knows short-termism is the name of the game and not just in this country—I was reading in the *FT* yesterday that Ericson's announced in its nine-monthly report that it was going to put up its spend on R&D by about 20 per cent next year, and its share price plummeted by about ten per cent.

Lord Tombs

1077. I wonder if I could take up something Professor Jeeves said. He was very pessimistic about the notion of senior industrialists giving up enough time. I would not be so pessimistic. If you look at the history of the research councils in their various forms, senior industrialists have given up a lot of their time. One just thinks of Sir John Cadogan, who has been Chairman of the Science Board of SERC, and Sir Geoffrey Allen and lots of others. Indeed I go further and I wonder if Professor Jeeves might agree that if that were not the case and if senior academics were not able to give time and still run their own departments then you would indeed have a professional class of administrators and that would be very dangerous. So it is quite essential that we find a way in which senior industrialists and senior academics will give enough time to make the system work.

(*Prof Jeeves*) May I, Lord Tombs, simply correct the record at this stage; it was the President who raised the point.

1078. I am sorry, in that case let me re-direct the question.

(*Dr Johnston*) I take the point entirely, my Lord, but I think it may not be being recognised explicitly what an important point this is, that industrialists will have to play an important and time-consuming role if the system is to operate at the appropriate level of quality and overview.

1079. I think they have shown themselves, if I may say so, capable of doing that if you get the right people. What worries me a little—and I would be grateful for your views on this—is that the expectations of the government of the industrial influence are growing. They are placing a great deal of weight on the value of the industrial input, some might think a disproportionate weight, and I wonder how one might measure that, how one might assess the value of that. The contribution is there already but its weight is being increased it seems to me by the White Paper.

(*Dr Johnston*) I find that a very difficult question to answer.

Chairman

1080. I think Professor Last wanted to come in on this point.

(*Prof Last*) My Lord Chairman, I have some fairly severe reservations about the Foresight programme. Lord Tombs has said quite rightly that industrialists have played an important part in the Research Councils and I have worked for two of them and have in fact in a way been helped by their activities but in actual fact in doing so they were working with bodies that have executive powers. After all if you are on the

[Chairman *contd.*]

Council of the NERC and so on you could in fact see some of your recommendations and suggestions carried through. Well now, in the documents that I have seen in relation to Foresight how is this going to be because here we have the Research Councils and the Director General of Research Councils who clearly has prime responsibility but then you have the Foresight Steering Group with a number of eminent people including people from business. They are going to make suggestions but they are not going to have executive power, at least that is as I understand, and that seems to me not to be a recipe for long-term retention of interest. It seems to me it would have been far better in a way to have encouraged the development of this initiative within the existing Research Council set-up that we already had.

Lord Dainton

1081. But in that context, Professor Last, as I understand it anyway the notion is that the Foresight programme will produce statements which raise up for everybody to see what the goals are and then the performance of the Research Councils and the science base will be judged against that thereafter. Is that not right and is that not a powerful influence?

(*Prof Last*) I have severe reservations. Personally I would have said that the Research Councils have the capability of taking that task upon themselves and would respond to that responsibility. I find the creation of another body might lead to a very unhappy relationship unless roles are clearly identified.

Chairman

1082. They were supposed to be doing that. There must be some criticism of them for not having done it successfully enough to have led to the creation of the Technology Foresight programme, must there not?

(*Prof Last*) Well I would just like to see the evidence of that criticism.

(*Prof Wallace*) Could I reply. Yes, I would echo this concern because from my experience in SERC I believe that a kind of Technology Foresight, including also a science foresight, has been undertaken by SERC over the period of the last decade or so in the development of Initiatives. Almost all of the new money that has gone into SERC on that timescale, and a good deal of what already was there, is actually now in the framework of Initiatives which are quite strategically or industrially oriented; and Innovative Manufacturing is the most recent one of these. I regard that as a Foresight—like activity which I believe the SERC has been following with some success over the last decade or so. I echo Professor Last's concern on the question.

Chairman] The introduction of molecularbiology by the MRC many many years ago was a brilliant example of technology foresight.

Lord Dainton

1083. They did not know what was going to come out of it, they just knew that it was a good subject. I wonder whether I could follow this up, my Lord Chairman, by just a simple point here. It does worry me somewhat to know what is the role of the Director-General of the Research Councils because in a sense he is going to be the recipient very obviously of these messages and the only way in which he can influence the research councils effectively is by holding back a little money to use that as steering money on the research councils. When you have been thinking about this set up which is proposed in the White Paper, do you see that happening and would you welcome it or otherwise?

(*Prof Wallace*) I am confused because my understanding is that the Director-General of Research Councils does not hold money; he is not in an executive position.

Lord Dainton] No, I am asking for your opinion on whether he should.

Chairman

1084. The ABRC did and now it does not, but the DGRC could again.

(*Prof Wallace*) Then you have to ask what is the mechanism for resolving the bids, as it were, which come forward from the Research Councils which represent the marginal losses or marginal opportunities to be gained from a redistribution of funding. I do not understand what that mechanism will be.

Lord Dainton

1085. That is a splendid evasion of my question, is it not!

(*Prof Wallace*) But it was honest!

Lord Dainton] Absolutely!

Chairman

1086. I think Sir Kenneth was trying to come in.

(*Sir Kenneth Alexander*) I really wanted to go back to Lord Dainton's point about the willingness of scientists, indeed their keenness and willingness, to put time in to seeing their work carried forward. The phrase "creative tension" usually seems to be one which is positive. I think we should recognise now that on the one hand the quality assessment pressures on the research side may weaken that willingness to which Lord Dainton was referring and perhaps the pressures following Technology Foresight may strengthen it. Somehow we have got to decide which of these two in this tug-of-war we want to be the dominant one. There is a real danger I think, reading the Research Council's mission statements and estimating the consequences of Technology Foresight, that basic research will be squeezed somewhat. The second point I would like to make, my Lord Chairman, if I may, is it seems to me the saving grace of Technology Foresight is that it is to be an open process and that should make it possible to make quick corrections if the scientific lobby is as effective as it can be (as I believe it can be). Once scientists accept that this is part of their lives, they ought to be able to influence the process very powerfully either by criticising what has been decided or influencing more directly what will be decided. The third point I make is that although the involvement of senior people in industry is important, I believe it is the middle level and more

[Chairman *contd.*]

active research level and more active decision takers on research and science within companies who will have to be involved. I think these are the people most likely to be able to make the effective connections between industry and universities.

Earl of Selborne

1087. My Lord Chairman, are we in danger of seeing this Technology Foresight exercise simply as interaction between industry and the scientific community? I think it was the President who referred to the need to bring the financial community in. Perhaps one might also argue that social sciences should be involved. Would you like to give your thoughts on that and perhaps whether there is a Scottish dimension, whether Scottish Enterprise or some other organisation has been able to involve a wider community.

(*Dr Johnston*) Before I forget, my Lord Chairman, could I mention Professor Last because he is from the environmental sciences and I would like you to feel it is not just industry and the science base we are talking about, but these wider issues as well. In terms of the financial community this is one of the strengths of the Scottish economy. We have an organisation called Scottish Financial Enterprise which seeks to identify matters of common interest and lobby on behalf of Scottish financial interests when it sees any national legislation on the horizon. I should have thought (although we have not yet been in touch with them about this) that they would respond if a message were to be sent across to them that we would like them to make some input into how they saw the Technology Foresight programme raising the opportunity for financial contribution. I am sure there is a resource in Scotland. In terms of the social sciences I do not think there is a particularly Scottish dimension. There is clearly an obvious socio-economic institution in place, Scottish Enterprise, which would want to see themselves as having an economic and social perspective and we would readily involve them. You could readily pull them into any discussions that involved that dimension but as regards social science research I do not think there is a distinctly Scottish issue. Again, as I said earlier, the Scottish scene seems to be well-represented in the Economic and Social Research Council.

1088. You have identified already that the financial community have a contribution to make which clearly has been a failure by any perception of the last ten or 20 years in a sense that the financial community has not been interacting with the scientific community or perhaps with industry in ways that we would have wished. Do you feel that the White Paper has any contribution to make in this respect, particularly the Technology Foresight concept?

(*Dr Johnston*) I think in principle it does but to be realistic, and I made the point earlier, so much industrial financial investment is short-termism. We must not forget that it is always going to be international. It is not necessarily going to be looking for a domestic outlet for funds.

1089. Has the White Paper addressed this issue?

(*Dr Johnston*) I do not think it has addressed it at all. I think there are just these noises about the importance of bringing the financial community into the process and I think it is important to do that. I was interpreting your question as meaning would there be financial resources set alongside any themes that came through. I think in principle we could say yes but in practice one has to recognise, as I said a little earlier, that a lot of these things are going to have a very very long period of gestation and also the financial community is accustomed to looking for—and the venture capital funds are an example—pay-back periods of about three years. This will be rather difficult to do. One is really looking for the financial community to say, "We can deliver an input of resources to make this happen in a reasonably credible period."

Chairman

1090. Would you wish us to recommend, for example, that the financial community be brought formally into the Technology Foresight arrangements?

(*Dr Johnston*) Personally I would, Sir. I do not know if my colleagues have any views.

(*Prof Wallace*) I would agree with the suggestion. I think it is appreciated by the Foresight team, according to an aspect of the presentation we had at the first of the Focus on Foresight meetings in this building in September.

(*Dr Johnston*) I was not present at that.

1091. Sir Kenneth, you must have a view about this.

(*Sir Kenneth Alexander*) I certainly think they should be brought in but I think their interest will be limited in discussing what is likely to become important until the scientists and the industrial technologists raise specific issues. I do not think one can expect the financial sector to get terribly excited about a very general 'overarching approach'. The financial sector will look for some potential relationship with the market.

Earl of Selborne

1092. But the scientists complain, I think quite rightly, from time to time of short-termism and the President has mentioned it. As Professor Wallace reminded us, one of the objects of the Foresight exercise is to have an interaction and if there appears to be a failure of the City to understand some of the imperatives perhaps this could be a mechanism where some improvement could be made.

(*Prof Wallace*) I would agree on that. I think it depends on the remit that you give to the financial people that you bring into this exercise. If the remit is to bring their perspective to the process then I think that would be wholly beneficial. If the remit is to pick financial winners then one would have grave concerns; for all the noises from the OST, picking winners is not the name of the game.

(*Dr Johnston*) I think there may be a culture problem also, my Lord, in that one understands that Japanese companies are not particularly interested in distributing dividends, they are very much interested in ploughing back into the business on a long-term

[Earl of Selborne *contd.*]

basis. I guess the investors are looking for long-term gain rather than short-term dividends. That is a completely different culture from what we have here. That is no reason why we should not attack the problem by getting people from the financial community involved in how to tackle long-term thinking. There must be people—it would be a matter of getting the right people—who are willing, in addition to their day-to-day bread and butter, to get involved in the kind of dialogue which is inherent in this Technology Foresight exercise.

Lord Dainton

1093. My worry is this: that at the end of the day when you have the Technology Foresight and when you have the scientists cooperating and when you have got the kind of movement that you want, all this will be of no avail unless it is picked up industrially or by those who can make things or produce new processes or whatever. Are you, like myself, concerned about that stage which is really not dealt with in the White Paper at all and perhaps we should make some comment on it.

(*Prof Last*) My Lord Chairman, I believe that it is an absolutely crucial stage. In the documents for this meeting there are references to scientists having to go to industrialists—however I think the emphasis should be reversed—industrialists should be asked to go to scientists. Sir Kenneth was making some comments about the development of Scottish Enterprise. I have had one or two contacts with them and I am very much involved in land use and environmental aspects and there they are very supportive on educational programmes. They see this as a prime involvement. They are not involved in funding science but are very willing to be involved in educational aspects of it, believing that that the transfer of knowledge is where improvement is needed at this particular stage. Now many years ago I was involved in horticulture and the thing that always worried me was that at an AFRC institute at Littlehampton we were dealing with glasshouse cropping for the industry within the United Kingdom but, the people who were keeping an eye on our activities were the Dutch: they were picking up most of what was useful very quickly whereas in this country that was not happening. There is a very major weakness I believe in the willingness, the capability or the understanding of a certain part of industry to take up and run with the outcome of science and technology. I really do not think that that is being pursued with sufficient energy at the present moment.

1094. There is a lack of awareness of what science, engineering and technology as practised in the science base can do for them?

(*Prof Last*) Has to offer, yes, very much so. Much of industry is not sympathetic.

Chairman

1095. Or is it the science base does not carry out the sort of science that forward looking industries think they should be doing?

(*Prof Last*) I believe there is some truth in that but on there other hand there is only *some* truth.

1096. That is the gap that this Technology Foresight programme is intended to try to bridge, is it not?

(*Prof Last*) Yes, but overridingly it is essential to get the industrial sector to increase its willingness to understand. I think that this is where there is a major blockage in the system.

(*Prof Jeeves*) I think there is a Royal Society of Edinburgh dimension in this. In the absence of our President last year and again this year I presided over two meetings here in the Royal Society of Edinburgh. Last year we had a meeting where we invited university principals and also leading industrialists. It was jointly organised by Scottish Enterprise and we had an extremely useful evening. I think one has to remember that Scotland is of such a size that we can actually get together many of the leading academics and industrialists and the whole evening was good and there were prepared speeches and talks and so on but I have to say that at the end of the day, having had the declarations of goodwill, one felt it was very difficult to say what had actually been achieved. Then again about four weeks ago we had another dinner in this room, again over which I presided and we had many of the same people. Sir John Cadogan was here on that occasion and we went over much of the same ground and yet again I had the same feeling that the goodwill was there but it was very difficult to see what the next steps were. I think I can understand this up to a point. Scottish Enterprise, no doubt for very good reasons, is more concerned with the immediate market place and what has to be done to expand industry and so on at that point. In a sense this actually extends the divide between the science base in the universities and industry because quite understandably they must focus on their remit. Therefore it is worrying to me to know how the actual science base in the universities is going to enrich what is happening in Scottish industry. We have it in mind at the Royal Society of Edinburgh certainly.

Lord Tombs

1097. I have a great deal of sympathy with this gap between academe and industry but can I just make one or two comments and then ask a question. First I do not think that there is much future in collections of universities meeting collections of industrialists. It makes for a very "motherhood" type organisation; everybody goes away feeling very moral and very little happens. There has to be far more direct contact. An industrialist looks at maybe 30 or 40 universities and finds the picture very confusing so I ask myself, Whose job it is to market the research? I accept that industry is often, not always, derelict in finding out what is on offer. I think very often universities are derelict in not promoting themselves. Afterall you would not expect to set up a factory that made widgets and wait for the customer to come and knock at your door. Now I have the impression, which is a limited one, that Scotland has been rather better at doing this. Certainly it attracts quite a bit of industrial research, more than some English universities I could name with perhaps better bases and better local contacts, and it seems to me at least possible that is because there is not much large

[Lord Tombs *contd.*]

indigenous Scottish industry and therefore Scottish universities have to look further and fight rather harder because of the links. Is that a generally perceived view and if so how does one read that into the industrial input on a wider scale? Let me just say one thing. One solution is for university X to approach Shell with a hard sell but if 40 universities did that it becomes a very complex issue for Shell and nothing may happen. How can you offer a challenge to universities and target industry as well?

(*Dr Johnston*) If one sees the universities, if you like, as supplier?

1098. But a bad marketeer.

(*Dr Johnston*) Modesty forbids that I should say too much about my former university, but 25 years ago it set up something like what Lord Tombs is thinking about. That was an enabling body—UNILINK—within the University to help academics to reach out and also a point of entry for companies who wanted to find out what was going on. I suppose research parks, of which Heriot-Watt had the earliest one, are along the same track except that it is intended to be much more of a good neighbours' arrangement where the feed across in both directions is very easy, within walking distance, so to speak. I think that is probably working quite well though I am a little out of touch with how to quantify it. It is very difficult to know how to quantify. I think there is a much bigger issue behind what you are saying, Sir, namely the very difficult problem of communicating information in both directions which is not necessarily dealt with simply between university people alone. The more I hear of the way in which Chambers of Commerce operate on the Continent, the more I wonder whether, if our Chambers of Commerce had a statutory role in the local economy or community, that might help the flow of information or at least focus it. The CBI in principle ought to be able to do that in Scotland because, as some of my colleagues have already been saying, it is small enough to know most of the people in it. Yet there is a set of layers for communicating information, some of which would be seen to operate as blankets rather than as channels of communication, and I think the whole thing is very very hard to express in the form of a marketing model. I think equally a lot of the things we have tried have been quite successful but it is difficult to say we have really got a strategy.

Chairman

1099. I thought that was what Scottish Enterprise was supposed to be doing.

(*Dr Johnston*) Except, as Sir Kenneth was bringing out, my Lord Chairman, Scottish Enterprise does not see its role primarily but only partly as that of moving out from the science base.

Lord Dainton

1100. Could I just follow this up because it does seem to me that it is a nexus in two senses; it is the key point in our argument, it is also the reality of the situation, is it not, that on the whole industry finds it difficult to be aware of what is going on in the universities and universities are not very good, as Lord Tombs has said, at putting their goods on the market. In your report you make some remarks about the necessity of data bases and so on but when all that is said and done I know from my own experience when I started a patent information network in the British Library and centres all round the place, how little it was used. It is very difficult to get this across. It does seem to me that some attention needs to be paid to that if we are to get them to follow the practice on the Continent which you quite correctly referred to where Chambers of Commerce, or their equivalents in Germany, as a matter of course involve the universities in their neighbourhood. Are you really arguing for a strengthening of that link by whatever means are possible and to come back to the original question are you also arguing for something to be said by us on the question of carrying out the Technology Foresight after a movement of culture has taken place or something to be said about financing?

(*Dr Johnston*) I think certainly on the latter. On the former I can only speak personally. I intend to make it my business shortly to have a meeting with the President of the Edinburgh Chamber of Commerce to see whether we can sit down and discuss some of these things that have been emerging.

Chairman] That is very interesting.

1101. Could you tell us, is there anything in Scotland in the way of the clubs which are developing round some universities?

(*Dr Johnston*) The university industry clubs?

1102. Yes.

(*Dr Johnston*) They do exist. Recently I was at a meeting of the University Industry Dining Club set up by Glenrothes Development Corporation, but again, if I may say so, although it was an extremely enjoyable evening it did have an element of feeling good afterwards without any clear action. All of these activities are part of networking and they do have an important role to play. I wonder if I could take up one point which has already been made and it perhaps makes a point about the difference between Scotland and Wales. I think we have a clear impression that Scottish Enterprise is focused on business growth and "locate in Scotland" and is directly addressing its remit to wealth creation—correctly. In a comparison with Wales my impression is that the Welsh Development Agency has taken a more relaxed view about its relationship with universities and supporting research in universities. That was certainly the impression that I gained from the evidence given to you in an earlier presentation. Scottish Enterprise is very much in wealth creation and directly on the business side of that and therefore there is less opportunity for direct support for the science base within universities.

Chairman

1103. We have not got much time left and we have been pushing you to talk about the things that are of concern to us at a very late stage in this inquiry and you can see the sort of worries we have, but we really came here to listen to what you have to say and I know that you want to talk to us about manpower and the dual support system.

[Chairman *contd.*]

(*Prof Jeeves*) I think there is one particular aspect of the manpower story which concerns us and that is the plight, I would put it as strongly as that, of some of our brightest young post-docs just after they have finished their first post-doc and before they get into some sort of university post. I know that the London Royal Society scheme has worked extremely well and in the SERC, as you know, we have the Advanced Fellowship Scheme which I was intimately involved with for my four years and I am still involved in it. I was always impressed by the enormous field of really talented people who are in competition for 24 advanced fellowships. In recent years we actually had people with readerships and professorships applying for these advanced fellowships. It did seem to me that when you consider the Royal Society Fellowships and the SERC fellowships this was only touching the problem and there is still a great cohort, I think, of talent which we are in danger of losing just at that stage in their careers. As you know, my Lord Chairman, one of the last things we did on the manpower sub-committee of ABRC was in fact commission a career path study, a feasibility study was just about to be done. That hopefully will give some information on what happens in this area but I would like to urge some way in which we can increase the opportunity for our brightest young scientists for another five years during that period to be actually concentrating exclusively on their research. I believe that there is a large amount of untapped talent there which is now slipping out of the system for one reason or another simply because they cannot get these posts at that time. I read your discussions with Professor Sizer and I was interested to read that one of you put this question to him and he made the comment, "I don't think that we can provide funds direct to individuals." Now I would want to query that because he says, "Leave it to the vice chancellors," but my impression is that vice chancellors are under enormous pressures for everything else at the present time and unless there are funds earmarked for these individuals they will of necessity get diverted into other things. I would very much like to see some way in which there could be additional funding for these really talented individuals to stay within the system and be allowed to go on as the Royal Society fellows do to concentrate on their research for another five years.

1104. There is nothing, if I may say so, to stop a fine upstanding vice chancellor from saying, "I am going to take half a percent of budget from somewhere and use it as a fund for supporting particularly bright people".

(*Prof Jeeves*) There is nothing to stop him, my Lord Chairman, but I think he is only human and there are so many pressures on him. Without wanting to introduce an unnecessary dimension, my experience of Oxford and Cambridge was that there we could retain people in the system because you had college lectureships, fellowships and so on for a long enough time for them to go on with their research and then get into posts. It would please me if we could have something similar here where we could do a similar thing within Scotland.

Lord Dainton

1105. Could I just put it to you as an alternative point of view, and as you know I am by all my tradition an academic, there are many in the country looking at the White Paper who would not see it as a function of the universities in those terms so much as to get able people out into the industry where they could do more good. Now, is that a false argument?

(*Prof Jeeves*) It is a half truth, I think. Clearly they want to be out there but I believe there is still this period when they should be able to stay undisturbed in their university laboratories to realise their potential without interruption and then I believe they will be of even greater use to industry when they get out there. I still think there is a place for enabling them to stay within their research groups for a longer period and I think they will enrich the science base much more.

(*Dr Johnston*) May I bring Professor Wallace in but say first of all I think the perspective that Lord Dainton has brought in is a very important one. Once you recognise the importance of young people in industry coming in the other direction and being able to be seconded from industry (there are all sorts of problems of disparities of salaries etc.) a point could be made in this context about the human resources involved in this programme including elements like that. We should be very happy about that. Professor Wallace would like to add to what has been said.

(*Prof Wallace*) My comment is one on the issue of age profiles in universities and the fact that many departments and subjects are faced with age distributions of staff which are very heavily peaked now with a predominant number of staff aged 50 to 55. The replacement of these staff over the next ten years as this shoulder moves to retirement will be a very serious issue facing the universities and the country generally. For example, there have been actuarial surveys carried out under Sir John Kingman when he chaired a review for the Mathematics Committee of SERC which showed that the number of SERC studentships in mathematics was not sufficient to effect this replacement never mind any other role that they might envisage mathematics playing. I think some form of bridging towards this would be important. I think there is a good case for thinking about a "new blood" scheme to deal in a smooth way with this very large shoulder of retirements occurring in the science base.

Chairman

1106. Who would you see running this?

(*Prof Wallace*) I believe that the Funding Councils could play a role in that. I believe there is consistency there; the Funding Councils would not be choosing the individuals but they can help by stimulating the way the new blood system could be introduced within ten years.

Lord Dainton

1107. But the Funding Councils by committing themselves to formula funding have almost opted out of this kind of initiative.

[Lord Dainton *contd.*]

(*Prof Wallace*) Yes but formula funding may have its limitations and one of the things the Scottish Funding Council can do is consult because the number of institutions involved is sufficiently small that it can actually do that.

1108. It might even abandon the assessment by crude numerical measures to actually meeting the universities, do you not think?

(*Prof Wallace*) I am not sure exactly what is behind the question but let me answer that I believe very much that a future research assessment exercise should indeed be a national one. We cannot afford to take a parochial view on that issue.

(*Prof Last*) I am very concerned about scientific capital—a topic brought up by my two previous colleagues. In recent years there have been changes and Research Councils, now have become very much mission- oriented in their research and, for whatever is said, there is absolutely no doubt that the element of speculative research being done within the Research Councils, with which I have been involved, has greatly diminished, very seriously diminished, and I think we will allow this situation to go on at our peril. There is no doubt that many of my former colleagues welcomed mission-oriented research but mission-oriented research usually followed earlier speculative research. I would like to link my comments with those of Professor Wallace and say that I believe that initiatives must now be taken to redress the balance. The capability of speculative research is in danger of being eliminated and, yes, one of the mechanisms that the Research Councils employed some years ago, particularly when concerned with age structures, should be re-activiated. It is necessary to think of a "new blood" scheme to allow the re-insertion of speculative research. I think that there will be a major failing if that is not done.

Chairman

1109. Could I just try to broaden it on this point; one of the things you wanted to talk about was the dual support system. We have a promise essentially, a statement from Mr Waldegrave in his evidence to us, that it is not his intention to transfer any more money from the Funding Councils to the Research Councils so that the Funding Council element of dual funding will remain, not as much as some people would like perhaps but it will remain as it is. Now it seems to me that that gives the universities some certainty that they can plan to use this money to look after speculative things, to look after supporting the incoming people—but not if it is just left to chance, it seems to me. I just wondered whether in Scotland you have an opportunity (because there are not so many institutions and there is a certain homogeneity between them maybe) to set aside some of your dual funding money to deal with those problems in a coherent fashion because that is what the money is intended for. It is only a question of how you coherently attack a given set of problems.

(*Dr Johnston*) Might I say two things, my Lord. I think what comes out here, particularly on the point Lord Dainton mentioned about the flow of people, is that the flow of people in both directions is going to be a crucial part of this programme if one is going to have a credible long term view of it. That is an issue which needs to be fleshed out explicitly with a declaration of it as an important issue. On the dual support system, my Lord, we have not got very many new points to make but in a moment I will invite my colleagues to come in. What I wanted to say is that we as a Society are really pleased not only with the way in which the Scottish Higher Education Funding Council appears to be convinced of the importance of the unit of resources and the dual support system but that it is also actually willing to come here and talk to us when it is thinking ahead about some of the exercises that it will have to conduct. Next week it is going to talk to us about how it might develop its own particular view of research. It is seeking to be transparent and it sees us as part of the process. I think that is helpful in the context of what you have said about the dual support system.

(*Prof Wallace*) My main line would be that the Funding Council component of the dual support system is primarily to support people and premises. It is people in the sense of people who get research grants from SERC for example, who are not funded directly by the Research Council but their time on that particular research project has to be paid for. Equally the Funding Council funding for research can support individuals to do speculative research. So viewing the funding council component of research as being primarily for people and premises is I think an entirely consistent thing to do; it complements the Research Council and leaves the universities with some freedom.

1110. Would you like to comment on my suggestion that you needed a coherent approach to the problem. The money is there for that purpose but there is no coherent mechanism at this moment for doing these things.

(*Dr Johnston*) I really meant to say the point you have made I will make to the Funding Council when they come here next week.

1111. Do you then see the Funding Council as the mechanism for this particular piece of coherence?

(*Dr Johnston*) I think it very well could be.

Lord Dainton

1112. My Lord Chairman, as Professor Wallace said earlier about the age distribution and its median point moving up to higher ages, some provision does require to be called for to meet that gap which links in with what we have just been talking about. In other words it is the Funding Councils' duty to see that the universities in Scotland are in good shape to discharge their teaching as well as their other functions by bringing on the young now, is it not?

(*Prof Wallace*) I would agree. I think it is a particularly important question in the light of the White Paper which is suggesting that there will be a general diminution in the number of PhDs. I think that issue has to be looked at subject by subject.

(*Prof Jeeves*) My Lord Chairman, there is one point on this which is relevant to the Royal Society of Edinburgh. We have a limited number of fellowships here for which we again have enormous demand so this is a point we intend to take up next week with the Funding Council because this is a role that the

[Lord Dainton *contd.*]

Edinburgh Royal could play in helping to identify these people and getting them into the system much in the way that the London Royal does nationwide. So I do think it is relevant.

(*Sir Kenneth Alexander*) Could I make one point, my Lord Chairman. We now have three sources for funding—we must remember the European Commission.

Chairman

1113. I hoped you might mention it.

(*Sir Kenneth Alexander*) Although it is not large I understand that they intend to add to the 28 per cent of the world research spend of the 12 EEC members perhaps a fifth or sixth. So it could be extremely useful. Most of it will have a technological link and some of it can be directly accessed by participating in the European training programmes for advanced technology. Britain is doing very very well in this area now. We have more collaborative links than any other country in Europe.

1114. Scotland particularly so?

(*Sir Kenneth Alexander*) Scotland is doing particularly well. The United Kingdom is the most popular country to link with from seven major European countries. Language of course is an important advantage. I do believe by paying more attention to developing these links and giving them some focus and encouraging industrialists to come more into the university and trading partnerships that have been developed here, that further progress can be achieved. It is important to get the industrial and financial sectors involved.

Lord Dainton

1115. Could I ask one question which relates to a point which is made repeatedly in the Royal Society of Edinburgh's document. Again and again you have used the phrase "a balance" between basic, strategic and so on. The question I really wanted to ask you is whether you see this as something (a) which is immutable or changing over time and (b) whether there should not be immense variation from subject area to subject area? It seems to me that, for example, botany is quite different in the natural sciences from, let us say, mechanical engineering. This does not come out in your paper. You speak of a balance as if there is a perfect balance always to be found somewhere.

(*Dr Johnston*) I do not think my colleagues intended to say it was immutable or in place already. I think what was implied is that if in this Technology Foresight programme one sees a sudden rush of resources away from basic science to applications of science through say electronics that rush would have to be done with express recognition that we might be denuding an important part of the science base. In other words, hasten slowly if you are going to make significant changes. Secondly, your point about the differentiation between subjects with regard to the flow of funds, I can exemplify the position at Heriot-Watt in the Mathematics Department which had low overheads. So much of the mathematics was done "in the mind". Mathematics need not be expensive yet it is a critically important quality element in the whole portfolio of a university.

Chairman

1116. Are there any points you would like to make that have not come out?

(*Dr Johnston*) Can I just reinforce something that I think has come out, my Lord Chairman, that if this Technology Foresight programme is to deliver over time then something has to be said about the importance of the people, the human resources, that the education sector is capable of producing, and the importance of this being nurtured properly. Equally that involves a partnership, as Lord Dainton is bringing out, of the users into the system, both in the way in which they use people coming out of higher education and the way in which they help our higher education system to grow. A marker about the importance of human resources which are going to underpin this programme would be very helpful to the higher education system and would also be a reminder to industry.

Chairman] Thank you very much indeed. Thank you for the whole session. We have never been disappointed coming to Edinburgh and we have not been disappointed this time.

WRITTEN EVIDENCE

Supplementary memorandum by the British Technology Group

Below are noted written responses to questions which were not posed during the verbal evidence on Wednesday 20 October.

Q.4 *What is your advice for those involved in setting up the Forward Look? What good do you think will come of it?*

A. Although a Forward Look has not been done in name before, individual departments, to differing degrees, have prepared strategies which are similar to the Forward Look. Over the last several years, ACOST reviewed these as part of its "Priorities Advice". The last ACOST review indicates the extent to which individual departments had been more or less effective at this medium-term view of their future S & T funding.

I believe it is positive to have a coherent Government view of what S & T spending is proposed across departments. It picks up where ACOST left off in its Priorities Advice.

Q.6 *Do you regard the interactions of the DTI with the science base as constructive?*

A. It could be argued that for some years DTI operated as an additional Research Council. This resulted in some confused relationships, particularly because the DTI both funded research and had responsibility for the exploitation of research by industry.

DTI is in the process of redefining its role, in which its principal aim is to help industry take up science and technology from the UK or elsewhere as part of the overall innovation process.

The result is likely to focus on particular areas such as LINK, which the DTI believes has developed a productive relationship between industry and the universities. Clearly there is further to go in encouraging UK industry to work with sources of technology, be they in the UK or elsewhere. It should be noted that BTG is a significant source of new technology from the UK, Europe and the US.

This review by the DTI is not yet completed but the changes and focus on the "absorptive capacity" of UK industry appear sensible.

Q.7 *From your experience, can you point to areas of the science base where significant sums of public money are being spent on research which is either pointless, second-rate or tantamount to product development? If so, what is wrong with the priority setting process at that point? If not, are we to conclude that in your view the present systems for setting priorities work well enough?*

We at BTG are not in a position to look across the entirety of research funding as to its value and it is very hard, and dangerous, to generalise in this area. We have, of course, come across some seemingly second-rate research, or research which pointlessly duplicates much else. However, "pointless" research can also have unexpected outcomes. I believe that much of the UK science base is first-rate and world class—the cup is 80 per cent full rather than 20 per cent empty.

However, the research grading exercise, which has now been through three cycles, is an important step in assessing the value of research. Our view, I believe backed up by the view of many Vice-Chancellors is that, as currently implemented, the research grading exercise is a good indicator of the quality of the research. The research grading exercise, however, directly affects UFC funding but has only a second order effect on Research Council funding.

We believe that research work, particularly in the context of wealth creation, should take greater account of patenting activity. We believe it is vitally important, particularly in the context of wealth creation from the science base, that the creation of patents and patent citations, for example, in the research grading exercise should continue to be an important part of the assessment process. Many companies use citation indices and patent indicators to identify areas of growing interest. This could well be one input used by OST, COST and the Research Councils to identify areas of interest or areas of duplication where the UK should, or should not, compete in funding research.

With respect to the "near market" issue, the UK has properly pulled back from the extreme position of a few years ago where the Government left "near market" research entirely to industry and Sir John Fairclough has explained why this should be so.

We certainly have seen examples where Government funding has in effect been spent on things close to product development but was crucial, and necessary, because of imperfections in the market-place. An example is the "Grainstripper" technology developed by the Silsoe Research Institute, funded by AFRC. In this case the technology is "needed" by the farming industry because it will dramatically increase the efficiency of harvesting. It has *not* been wanted by the agricultural equipment industry because it will reduce the size of their market for combines by 50 per cent or more. The market imperfections here are:

(i) The industry that will benefit (farming) is too fragmented to undertake its own research. Analysis in the US shows that US Government funded applied research in farming has had rates of return of 30–100 per cent over the last 50 years.

(ii) The equipment industry is comfortable with the status quo.

In common with other BTG inventions that have transformed industries the licensing process has been first to find a small (in this case UK) company that is willing to enter the market, followed by other licensees for developing the global market. The Grainstripper will bring significant benefits to UK cereal farmers. Saving fuel of about £2/ton of wheat harvested—(£50m/year for the UK, £250m/year for Europe, if used for all wheat harvesting) it has initially been accepted more quickly by rice farmers in North and South America, which is where the bulk of the sales have so far taken place. It is only now slowly beginning to be taken up within the UK and Europe—perhaps another example of the UK and Europe being relatively slow to change and respond to a new opportunity, although in the case of one large manufacturer, the European subsidiary proposed to take a licence, but was stopped by the US parent!

Q.8 *Professor Alec Jeffreys of Leicester gave us his opinion that "the great strength of UK science lies with the imagination and ingenuity of the lone scientist or small research group", rather than "large consortia" as in some other countries. Do you agree? If so, does this have implications for the future of public funding?*

A. We need both.

On the one hand large consortia enable funding of expensive equipment to be shared amongst a significant number of researchers. Their size can create the intellectual ferment that can create, develop and build on scientific ideas and it provides a critical mass for attracting the best researchers who, as a body, will move knowledge forward.

But on the other hand we also need to have continued funding availability for the small group or worker, who understands what is going on in the scientific community and is prepared to head off in quite a different direction and not be "part of the crowd". Alec Jeffreys himself is an excellent example of that.

As a comparison, it is worth noting that Glaxo, in its new research structure, has identified that new chemical entities (NCEs) are just as likely to arise outside Glaxo as inside. These will be in the small "research boutiques" or elsewhere—in our experience often from universities. What a company such as Glaxo is undertaking is to maintain links with these centres of excellence, be they large or small, and then pull them effectively into Glaxo's project management system to develop the idea efficiently, effectively and in a timely way.

BTG's view would be that we need to have both the large research centres and retain the funding diversity to support the small researcher who may have novel ideas but is at variance with his peers.

Supplementary memorandum from the Edinburgh Centre for Rural Research

1. There is a clear lead from government that, in future, public funded research institutes will have to be working more closely with the "industry" they serve, in order to facilitate wealth creation and the public good.

2. There is also a clear indication from the research funding councils that close liaison between research stations and Universities is to be encouraged, and also that there should be more conjoint research conducted by research organisations so that expensive resources, such as pieces of laboratory equipment, can be put to optimal use.

3. Indeed, there is a suggestion in certain Ministerial statements and White Papers that the UK research base has not yet taken on board the above two requirements. It is therefore of possible interest to the members of the House of Lords Select Committee to know that 19 different research bodies which comprise the Edinburgh Centre for Rural Research have been putting these precepts into practice for a number of years, and recently have revised the terms and conditions of ECRR so that this is now its chief aim and objective.

4. The ECRR, however, has not had to commence from a stationary position in this respect but from a flying start. At the turn of the century the Scottish Office set up three agricultural Colleges in Scotland, charged with the three-fold mission of Research, Extension and Teaching. Each of these three Colleges was strategically sited close to an ancient "parent" Scottish University—Aberdeen, Edinburgh and Glasgow. The students at the three Colleges were partly taught by the staff of the "linked" University, and University undergraduates in agriculture were in turn part-taught by the "linked" College staff.

5. This system has immense pay-offs. The agricultural and college students returning to the farming industry already had close working contacts with specialists now exercising their other role as agricultural advisers. A good rapport already existed and, throughout this century, the "uptake" of science from the Universities and their linked Colleges has been very great, and far in excess of the "uptake" of advice south of the border where agricultural education, research and advisory activities are all conducted by separate organisations with few if any formal links between them.

6. Over the years, this system has developed further, and now a similar situation exists with such subjects as forestry, aquaculture and the environmental sciences.

7. The above is a brief description of "the Scottish System". It mainly applies to the rural sector and rural industries, but there have been spin-offs in other directions. Thus very close co-operation now exists in teaching and research in related areas, involving such "new" organisations as Scottish Natural Heritage and the ITE research Institutes funded by NERC, and the newly formed Roslin Institute funded by the AFRC.

8. Further expansion of the above points can easily be offered, if required, and there is an offer on the table for members of the Select Committee to visit Bush and see the system working in practice.

November 1993

Letter from the Department of Health

Thank you for the opportunity to provide comments for this Inquiry about the role of the universities and the Higher Education Funding Council. You have already received a copy of the revised edition of "Research for Health"[1] which was published in June.

The research carried out in universities covers basic, strategic and applied work and makes an important contribution to the health of our economy and society. This is the approach set out in the White Paper "Realising our potential". Our own strategy document "Research for Health" reinforces the message of "The Health of the Nation" White Paper which emphasises the importance of directing activity to the health needs of the country. In line with this approach the Department of Health would like to see more emphasis on research which takes account of the health as well as the wealth needs of the nation.

The Department participated in the Universities Funding Council (UFC) 1992 Research assessment exercise as assessors to the health panels. We will be discussing shortly with the HEFC what contribution the Department, and perhaps representatives of the NHS could make in future exercises, in addition to providing comment on the research work in direct receipt of our funds. We could provide views on the extent to which the research assessed, was or had potential ultimately, to serve the national interest and need for research in a particular field. Clearly a Department of Health contribution would give weight to research which could result in health or welfare gain for the population as a whole, in cost-effective improvements in health service performance, and in wealth creation either directly or mediated through better health of the population including a healthy workforce. We would like to see further consideration given to measuring and weighting these aspects of academic research endeavour. We do not see this as necessarily a request for more applied work. This concept of relevance applies across the spectrum of basic, applied and strategic research.

Secondly, in relation to the basic formula for the allocation of monies which takes account of the research of academic staff, the Department would welcome discussion of how weight can be given to staff supported by Government funds other than the HEFC. Currently, only those academic staff paid from an institution's own HEFC funds are counted, and research assistants (along with postgraduate research students) are given significantly less recognition. We feel that this aspect needs some further consideration given that the Department along with other major funders supports senior staff in university research units which may, as a direct result, achieve high assessments for the research. If these staff are not counted in the funding allocation method then this disadvantages that institution. A less restricted system would enable universities to "win" HEFC money on the basis of the total numbers of research staff carrying out that research rather than only those they directly fund. A clearer picture of the consequences of these funding decisions would assist judgements about whether this allocation method is producing an incentive to research that is in the nation's interest.

Additionally, the Department is keen to ensure that when a university is awarded funds decisions about the allocation of monies are taken on the basis of agreed and transparent priorities and help consolidate the infrastructure. For example, we are conscious that among contract researchers and in many research units there is no career structure and no long term job security for the high quality research staff working there. We would like to see HEFC funds help ensure that this valuable staff resource is not lost from the system, and possibly used to finance theoreticial and basic work to underpin good applied work funded on contract.

In terms of the RTX model, the Department's own arrangements reflect the moves by the HEFC to concentrate research money to allow research centres to emerge. The Department is cautiously moving research money to larger centres of excellence with the main aim of maintaining high quality work but also in recognition that such quality usually requires a multi-disciplinary approach. In extreme cases this model can lead to small expert teams of researchers being starved of funds. The Department is acutely aware of the need for the specialist skills that such teams can provide and wishes to encourage the development of arrangements which do not lead to loss of flexibility.

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[1] "Research for Health", Department of Health, 1993

M J Peckham

6 September 1993

Letter from Professor JBL Matthews FRSE, Director of the Dunstaffnage Marine Laboratory

Following the stimulating and enjoyable discussion at the Royal Society of Edinburgh last Wednesday, I am pleased to provide some answers to the questions that had been posed beforehand and to enclose two documents which may be relevant for your records. The first is the Strategy produced by SAMS earlier this year which exemplifies the thinking and activity of a grant-aided scientific association; the second is the response of the three associations, the FBA, the MBA and SAMS, to the White Paper.

Taking your questions in order:

1. *The setting of priorities*

The scientist should retain the initiative, though responsive to national priorities (the availability of funds ensures this!). The most decisive factor in appointing a SAMS research fellow on baseline funding is the excitement that his or her application engenders. Additional funding must be relevant to this, though it is of course dependent on the priorities of others and on current "fashion" (the peer-review system).

2. *Application—Wealth Creation or Quality of Life?*

The crucial importance of the seas and their resources to Scotland provides the raison-d'etre of SAMS. Not only must fundamental understanding increase, but only those with fundamental understanding can provide fundamentally sound scientific advice.

3. *Co-ordinating the requirements of different patrons?*

There shouldn't be a problem in this if the scientists retain the initiative, though there can be if there is a need to provide specific answers quickly—one aspect of the pervading problem of short-termism.

4. *Constraints?*

(a) No recognition of, or commitment to, the problem: Contrast the situation with regard to Coastal Zone Management, not yet politically accepted, with Biodiversity, to which there is a post-Rio commitment.

(b) Inadequacies of the methodology: The emphasis on high resolution (large masses of data) results in a gap between technologically advanced areas of research, on the one hand, and labour-intensive areas, on the other. Biological oceanography is currently a prime example of this where available methodology favours a physics-driven biogeochemical approach in terms of total budgets, rather than an ecological approach to the communities of organisms.

(c) Current scientific fashion: Modern digital technology encourages "Kelvinism", and discourages the "soft sciences" (social and ecological), which on grounds of Quality of Life ought to be high priority.

(d) The craze for reviewing and clarion calls for "value for money": These direct time and attention from productive science, detract from the trust that should exist between patron (or customer) and the scientist (the contractor).

5. *Funding set-up*

Although the White Paper re-affirms Government's commitment to fundamental research, this is somewhat negated by the emphasis on wealth creation in the document itself and following publication. There are already signs in Research Councils that this will influence priorities. A very great deal of credible foresight will be required if areas of truly long-term benefit are not be neglected.

6. *Government plans*

(i) A compulsory M.Sc. before Ph.D. is not without difficulties which have not been fully thought through in the White Paper. There are some subjects (principally not in science, however) where it is inappropriate and where no M.Sc. course currently exists. Conversely many vocational courses, designed for immediate managerial careers, do not provide a suitable basis for a Ph.D.

(ii)-(iv) These three objectives need to be tackled jointly. Research scientists must have the support of professional assistants and not be tempted to seek studentships as the only means of obtaining such support. A change of attitude is required on the part of industry, academia and postgraduates alike that a Ph.D. does not overqualify, and therefore disqualify, a candidate from a post in commerce or in politics.

(v) I favour a shift in emphasis from grants to fellowships, in particular because this places the scientist in a position of trust. Fellowships are essential as the initial part of a satisfactory career structure. Greater security is needed further into one's career.

7. *Collaboration with industry*

At one extreme, this can involve interesting problems investigated in a climate of mutual understanding and respect, and with reasonable financial rewards to the scientist. At the other extreme, it can distract the scientist from his primary responsibilities at a cost that is impossible to count. When contracts are the only means of obtaining essential capital equipment, facilities or support, primary loyalty shifts to that customer—the principle of accountability and one of the tenets of Government!

8. *Work in a Research Council institute*

Such institutes are inherently well placed to carry out strategic research and it is gratifying to see signs that long-term studies are less out of favour now than they were just a few years ago. The directed nature of much of their research and the relatively short-term nature of their grant/review systems militates against the more innovative, speculative, high-risk research that might not pay off in terms of "performance indicators". It is, I am sure, every institute's director's ambition to have some financial flexibility with which he could gamble on his best scientists!

9. *High-level policy*

Institutes receive signals of Government policy,

(a) directly from Government publications,

(b) as interpreted by the Press, and

(c) as mediated through the institutional hierarchy.

The last is the most influential since it is the one heard most insistently and the response must return by the same route. Consciousness of major policy issues, the decision-making levels in the research councils, may favour research in the "big science" mode, rather than more fragmented or less captial-intensive (but more labour-intensive) science. Within marine science, it may be timely to review the major research areas identified by the Co-ordinating Committee on Marine Science and Technology in its 1990 report, and to consider which of the collaborative research projects suggested in that report have—and just as importantly have **not** been initiated.

I wish you well with the Report and look forward to reading it when it is published.

1 December 1993

Letter from the National Office of Animal Health Limited

NOAH, and its predecessors, have represented the UK manufacturers of licensed animal medicines in the UK since 1955. Today NOAH has 35 corporate members and two associates together representing 61 companies. NOAH members supply approximately 96 per cent of the £224 million per annum UK market, export about £150 million and employ about 3,000 people in the UK.

NOAH members supply products for UK pet owners and farmers, via animal health distributors, pet shops, veterinary surgeries and hospitals. From the simplest flea powder to the most sophisticated anaesthetic the industry's products are overwhelmingly aimed at animal welfare: 40 per cent of sales are for pets and horses—the highest percentage anywhere in the world and 95 per cent are preventive and therapeutic.

Over the last ten years UK medicines law has been steadily adapted to comply with EC Directives—often in advance of the rest of the EC—and implemented with greater zeal. While NOAH, representing a responsible industry, recognises the need for regulation, politicians and officials also have a responsibility to recognise that too much legislation can prevent essential products from reaching the market—denying animals, their owners and vets access to the latest fruits of veterinary science and so compromising animal welfare.

The National Office of Animal Health wishes, on behalf of the UK Animal Health industry, to make the following points in response to some of the questions posed in the above named document.

1. *What is public expenditure on the science base for?*

Public expenditure on the Science Base should apply to any project which improves the knowledge of the UK Research and Development sector, but which does not lead directly to a saleable product.

In the years since MAFF's "Barnes Review" of Agricultural Research the concept of "near market research" as a criterion for excluding public funding of projects has become discredited. It is now accepted that this concept makes no distinction between projects for which a commercialisable product is the end point and projects which have no direct commercial value but are "near use" (for example in the field of epidemiology, or husbandry methods which improve animal welfare).

2. *What information and advice is needed by those who are setting priorities? How do they know what is going on in current low priority fields? How do they track developments overseas?*

Information must be gathered from those closest to the relevant sector. In relation to Agricultural Research NOAH regrets the ending of the Sectoral Groups such as the Monogastric Group which acted as an effective link between the research base and the Priorities Board by bringing together representatives of MAFF, Government and independent research institutes, feed and medicine manufacturers, breeders, farmers and food processors. As part of its work the MASG monitored activities in competitor countries.

5. *How do charities and companies which fund research set and implement priorities? How is it done overseas? Are there lessons here for the Government?*

Because of the ever growing demands of the licensing system (UK and EC) Animal Health companies are often obliged to give first priority to defending existing products through the changing regulatory processes and thus to protect their existing business. This absorbs an increasing proportion of "Research" funds. Companies can only invest in projects which will lead to a marketable product or service. Because the price of a product is governed by the animal owners' ability to pay, the funds that can be devoted either to new research or to defending existing products are directly linked to forseeable profits. Excessive demands for regulatory data can remove the likely pay-back on a project and so stifle research into the development of new products to prevent or relieve animal suffering. Competitor countries (France, Holland) seem to have a more generous attitude to the "Public Good" both in research funding and licensing policy.

Priorities are based on funds available; this usually is a matter of company policy and budgetting as to how much can be spent on R&D over the rolling next five years. Once this figure is agreed the decision project funding will be based on a number of factors such as the company's strategic intent, market opportunities, barriers to entry, competitor activity, capital requirements of the project and political trends which will together lead to a financial pay back analysis of return on investment.

For the reasons outlined above, it is regretted that a very low proportion of commercial R&D expenditure can be devoted to fundamental research, while issues such as rearing systems, which have little opportunity for commercial pay back, are neglected unless funded by MAFF.

I am enclosing two documents, which I hope will be of interest to the Sub-Committee, the NOAH position paper "Animal Health Research in the Public Sector: The needs of Industry" (*not printed*) and a summary of the animal health industry R&D expenditure survey.

Roger R Cook, Director

December 1993

ANIMAL HEALTH INDUSTRY

A Survey of Research & Development Expenditure May 1993

A survey of the Research & Development expenditure of NOAH members companies has revealed a number of interesting and worrying aspects of research into animal health and welfare. The industry invests a significant proportion of turnover on Research & Development, total expenditure represents an investment of £42 million per annum, 18 per cent of the industry's total annual turnover of £232 million.

Some 25 per cent of the Research & Development expenditure is devoted to the support of existing products, particularly the recent review of pharmaceutical licences and the current review of biological licences.

A high proportion of all expenditure is devoted to satisfying the regulatory authorities at both national and European level.

Only 6 per cent of funds were spent on Biotechnology.

NOAH members predicted a decrease in Research & Development expenditure in real terms.

The survey indicates that, with an estimated 50 per cent of funds spent on the regulatory process alone, and a decline in investment in the future, the funds available for more fundamental research to treat and prevent disease in animals in UK are depleted and will continue to decline. This trend is likely to reduce significantly the introduction of new medicines and vaccines for animals with long term adverse implications for animal welfare, as well as the well-being of this important UK industry which although having a turnover of only £232 million per year is better judged by its contribution to the health and welfare of UK's pet and farm animals, and the £8 billion output of animal produce from UK farms.

Letter from Sir Mark Richmond

You asked for further comments on the exam paper set by their Lordships. Your letter of 25 October 1993 refers. This reply is a personal one and should not be seen as representing SERC. One of my colleagues, John Merchant, is preparing our formal reply *(see below, p 256)*.

4. *How do your read your new mission statements? How do you intend to act upon the requirement to "enhance the UK's industrial competitiveness"? (For instance, in considering grant applications, do you envisage a "first cut" for excellence followed by a "second cut" for industrial interest, as intimated to us by Mr Waldegrave on 13 July?)*

I feel a large amount depends on the extent and the manner in which the peer review system is altered in the light of the White Paper. I feel the presence of more industrialists on the review committees is more likely than Mr Waldegrave's comment since to take his route, would greatly increase (double) the administrative work load. In this area please also note that much will depend on how the Funding Councils react. The central question, perhaps, is whether both legs of the dual support system change to reflect the new missions. It will be interesting to see what the Funding Councils propose.

5. *Does the Science White Paper change the position of basic science in the mission of each Council? Dr Geoffrey Robinson of DTI told us on 16 June that a preference for market-orientated research, as signalled by the White Paper, is not in conflict with your historic commitment to basic research: do you agree?*

I think the White Paper has to be seen to damage the support of basic science. For the first time the Research Councils are given the mission *inter alia* of supporting applied research. This new area of involvement—without any extra funds—must tend to draw resource from the "pure" end of the research support spectrum. I also feel it is odd for DTI to argue as they do. On the day that the White Paper was published DTI withdrew about £20 million from the support of near-market research—mostly in the area of their Advanced Technology Programmes (ATPs). The onus will now fall on the Research Councils to fill the vacuum created—a role they will be pressed to do by the widening of their mission to include applied research—see above.

11 November 1993

Supplementary memorandum by the Royal Society

Replies to Questions not covered by the Royal Society Oral Evidence of 30 June 1993

Q.4 *What can the UK learn from how other countries determine priorities for publicly-funded science?*

Methods and procedures anywhere develop in the context of society. They are defined by its social, economic and political priorities.

There will always be the opportunity to learn something new by examining the systems of others and this can be a valuable undertaking. However, successful performance in one culture does not guarantee the same in another. This is particularly true when the cultural differences are as extreme as those between Japan and Europe.

Q.8 *Does the White Paper put the OST in a position to nurture a Whitehall-wide view of national science and engineering policy? What might this amount to?*

The OST has a dual role: as a provider of support through the Research Councils and as a coordinator and overseer of S&T activity elsewhere in the public sector.

It should be the OST's role to see that where publicly funded work in similar areas is being done it is carried out to the same standards, there is no unnecessary overlap and any gaps are noted. Also, OST should be able to recommend allocation of work to the best research groups (in the spirit of value for money in the public sector).

Therefore for the OST to bring about a Whitehall-wide view of national science and engineering policy it must achieve two things. It needs to know the type and quality of the research being supported by each government department *and* be able to influence the distribution of projects and funding between them; the latter in the light of its knowledge of the needs and activities of industry and of what it funds or plans to fund elsewhere. That is, it should be able to take a strategic view of *all* publicly funded S&T research.

Finding out what is going on where will depend on the relationships the OST is able to develop with other government agencies; nurturing will be required here. Being able to influence funding allocations and work distribution will require more than nurturing. In fact it would appear to need a good deal more power than is currently apparent in the OST.

We had argued in our Science Inquiry report that the OST should be allocated, in addition to the Science Budget, a small separately identifiable budget to meet:

(i) subscriptions to international facilities and programmes, established by intergovernmental agreement, where continued involvement needs to be reviewed in a broader context than the functional responsibilities of any one Department/Agency;

(ii) activities transcending the responsibilities of individual Departments that nonetheless are, actually or potentially, vital components of the national R&D infrastructure;

(iii) complementary funding for certain EC-supported research projects.

We maintain the view that the impact of such a budget, necessarily decided in the light of broad consultation within and outside Whitehall, would be altogether greater than its mere scale (of approximately £100 million) might suggest.

The OST has not been allocated such a budget and it is not clear from whence it will derive the "clout" necessary to influence the government departments.

We have stated what we think the OST should be able to do. It would be interesting to know from the OST what *they* think they require in order to do it.

Memorandum from the Royal Society of Chemistry

INTRODUCTION

The Royal Society of Chemistry is the professional scientific and learned organization for Chemistry in the United Kingdom and is the World's oldest such society for the science of Chemistry.

The Society is a non-profit making body with a duty under its Royal Charter "to serve the public interest". In this spirit the Society undertakes a wide range of activities to promote the education of Chemistry at all levels within the education system and equally to promote the understanding of science (especially Chemistry) among Parliament and the Public.

The Society greatly welcomes the Select Committee's inquiry into the subject of "Priorities for the Science Base".

This inquiry is particularly timely in view of the higher profile which Science and Technology now enjoys in political debate. The appointment of the Minister for Science, the establishment of the Office of Science and Technology [OST], and the creation of a new Select Committee on Science and Technology in the Commons testify to the increasing importance of Science on the political agenda.

The Impact of the White Paper

The Society is particularly mindful of the impact which the Government's White Paper "Realising Our Potential: A Strategy for Science, Engineering and Technology" published by the Chancellor of the Duchy of Lancaster, the Right Honourable William Waldegrave MP, will have on the developing debate about the nature and role of Science and Technology in the UK today.

The Society recognises that some of the proposals contained in the White Paper to some extent cut across the Questions posed by the Select Committee and—in the light of some of the proposals for structural reorganisation announced by the Minister—now overtake some of these Questions. Accordingly the Society's own submission seeks to take account of the White Paper in framing its own responses to the Select Committee's Questions.

The Society hopes that the Select Committee's Report will, together with the White Paper, play a positive part in promoting a wider appreciation of the vital importance of the UK's science base to its future prosperity.

The Scientific Needs of Society

In recognising that the Government's science policy—and the funding policy which accompanies it—should be driven by the needs of society, it is most important not to interpret such needs in a narrow, purely industrial or commercial sense.

An understanding of the nature of the World—and the Planet Earth on which we all live—is as essential to humankind as an understanding of other aspects of human life. Moreover, while there is a widespread and growing knowledge of the common problems that beset us all—including global and environmental challenges—there is also a growing appreciation of the role which science and scientists can take in tackling, alleviating or helping to solve these problems.

It is also important to understand that many highly desirable goals require funding time-scales that extend considerably beyond the lifetime of any one Parliament or Government. In general terms, achieving a balance between the shorter-term pressures of Government or the City and the benefits of taking the longer-term view is difficult. But a better and deeper degree of mutual understanding between the world of Science and that of Government and Industry can only be beneficial in the long run.

The Structural Framework of Chemistry Research

While every Government will naturally wish to examine whether it has the best possible structure with which to deliver its science and technology policy, a major reallocation of resources for research cannot in general be carried out rapidly without severe disruption and relatively high initial costs (including opportunity costs). This is especially true of the so called "Big Sciences".

The Society has already conveyed to the Chancellor of the Duchy of Lancaster its initial concerns about the reorganization of the Research Councils (see copy of letter attached as an Appendix). In the light of subsequent developments, such as the report of the "boundary commission" under the chairship of Sir David Phillips, the Society is still concerned that the reorganisation should not diminish opportunities for the funding of chemistry research whether from the Engineering and Physical Sciences Research Council or the Biotechnology and Biological Sciences Research Council or any other relevant research council.

THE SELECT COMMITTEE'S QUESTIONS

Q.1 *What is public expenditure on the science base for?*

Public expenditure on the science base is necessary for a number of reasons including the following:

(a) To ensure that there is an adequate knowledge of science in all branches of our activities from Government itself to the Education system.

(b) To ensure that there is an excellence in the Nation's science research in Industrial, Research Council and University Laboratories.

(c) To make discoveries which both stimulate the public imagination and provide the long-term basis for further economic prosperity.

(d) To provide an educated body of people, some of whom will ensure the continuation of research [see (a) above], but also to provide that those serving in public life, and indeed the general public, are better able to assess the validity of scientific developments. [It should be an important subsidiary objective that, for example, a substantial proportion of the holders of public offices of all kinds should be scientifically literate in the way that a knowledge of the classics was considered essential for an educated person in the 19th century.]

(e) To ensure the economic and cultural health of the country: to create, teach, develop and apply new knowledge and to ensure that there is sufficient investment in the future of "UK plc" in an increasingly technological world.

(f) To underpin industry and wealth creation by the supply of trained staff and by innovation in science and technology.

(g) To maintain the international standing of the UK as an enlightened and civilised country and sustain and improve the UK's world standing as a country of scientific excellence and achievement.

SUMMARY

In summary, public expenditure on science should seek to advance scientific knowledge; to promote the health of the people; to train people in research methods in general and specific subjects and skills; to generate knowledge specifically aimed at improving the economic well-being of the Nation (including wealth creation, new products and processes, improving industrial competitiveness etc); and to promote cultural well-being and the quality of life.

Q.2 *What are the objectives and priorities of the various funding agencies (Research Councils, HEFCs, other departments) within government? Are they related? Is an overview required and do the existing structures (ABRC, ACOST, OST) provide it?*

Any Government wishing to formulate a coherent national strategy for science and technology, or wishing to develop its policy in this area, will need to address all the issues involved—whether of structure or of funding or of purpose—across the full range of Government departments and funding agencies. An overview is essential for the development of science and technology policy. Only central Government can take such an overview.

The Society's original response to these broad questions was first drawn up prior to the publication of the White Paper "Realising Our Potential". In the light of the changes to be made by the Government to the "organisational map" the following comments by the Society have an "historical quality" to them and to some extent have clearly been overtaken by subsequent events.

The Research Councils and the Higher Education Funding Councils

The objectives and priorities of the various funding agencies should be complementary. Both should seek to fulfil the strategic objectives of a national science and technology policy in their respective areas. In practice there are some significant differences in the objectives and funding priorities of the Research Councils and the Higher Education Funding Councils [HEFCs] but there is also an appreciable area of overlap.

The five Research Councils distribute their funds in somewhat different ways but all provide substantial funds to Higher Education Institutions [HEIs] in the form of research grants and studentships. With the exception of the ESRC (much the smallest of the councils) they all carry out research in their own institutes and while the percentage of their total funds being deployed in this manner has fallen continuously, and very substantially, over the past decade it still represents 50 per cent or more of their total expenditure, with the exception of the SERC. The SERC also differs from the other research councils in spending a very large percentage (> 20 per cent) of its total funds on International Subscriptions (largely CERN). It should also be noted that some of the units are in fact located within HEIs, especially within the Medical Research Council [MRC].

There have been significant changes in the nature of research that has been supported in the past decade with a move from basic to strategic research. For example, the Science and Engineering Research Council (SERC)—which is by far the largest of the RCs—has moved from a ratio of basic/strategic of 60:40 to a ratio of basic/strategic of 40:60. At the same time there has been an increase in funds allocated in a proactive way with a corresponding reduction in reactive mode funding.

The relationship between the funding by HEFCs and RCs of HEIs known as the *Dual Support System* has undergone major quantitative and indeed qualitative changes in recent years. In the past HEFCs provided funds intended to be sufficient to provide the basic research infrastructure with the RCs providing funds to support specific projects.

Even before the recent (and continuing) transfer of funds from HEFCs to the RCs there were already signs that HEI funding from the HEFCs could no longer provide the basic infrastructure. Thus significant numbers of semi-permanent research staff were supported by "outside funds" and some of the equipment basic to a well-found laboratory had to be purchased using RC funds related to specific research projects.

It became increasingly clear that some major restructuring—such as the concentration of research in fewer HEI departments—was required if the Dual Support System, even in a modified form, was to survive. The process of change was accelerated by the decision to transfer substantial funds from the Universities Funding Council (UFC) to the RCs. (This was essentially related to the overhead costs of Research Grants that the UFC, and now all the HEFCs, previously provided via its contribution in salaries and basic laboratory running costs). These changes are not yet complete and some problems have emerged that are being tackled in a systematic way involving detailed discussions between the relevant groups from RCs and HEIs. Nevertheless, the results of these changes present some dangers and perhaps unexpected changes for those working in the HEI sector.

The "old" system did allow HEIs to use substantial sums in support of the research of young new members of staff who did not yet have an established reputation. There is evidence that there was often a willingness to support research at its early stages when its development was not yet at the stage when a request for special research funding from RCs could be made. It would be serious and indeed dangerous if these funding possibilities were seriously eroded: the process has already gone as far as is safe.

For example, if young members of staff cannot be supported then it is difficult to see how there will be sufficient staff mobility in the system to allow movement of such young people from good to excellent research departments—which is essential if the process of concentration is to succeed—and there is the further danger of support for previously excellent centres being continued when they have well passed their peak.

Another cause for concern relates to the nature of the research supported by HEIs. In the past this has been very strongly biased towards basic, curiosity-driven research. The transfer of funds to RCs, with their own changes towards even more strategic and proactive research, will have a (perhaps unexpectedly) magnified effect.

Multiple sources of funding—a topic to which further reference is made in this submission (see below)—are important in providing robustness to the system, maintaining its versatility and ability to adapt to new circumstances, avoiding also some of the dangers inevitable in the concentration of resources. However, it does mean that an overview is all the more important.

At present there are perhaps too many bodies involved in providing such overviews and advice. They have different but overlapping interests. The existence of the Office of Science and Technology (OST) provides an obvious starting point for greater coherence and co-ordination especially between RCs and HEFCs and to some extent Government departments. With OST in existence it does not appear to be necessary to have both the ABRC and ACOST.

Finally, it should be noted that even though the funds available for support of "Big Science" have fallen as a *fraction* of the total available to the Research Councils they still represent a very substantial sum of money.

The fact that much of this expenditure is in the form of international subscriptions—and hence has been particularly sensitive to fluctuations in the exchange rate—has been highlighted many times in the past.

The political problems, as distinct from the purely scientific ones, in making any changes are well known. What is perhaps not so obvious is that with the moves from basic to strategic research the funding of Big Science—almost entirely "basic"—means that it represents an even larger fraction of the total basic pool. It is almost certainly not realised by even the scientifically informed members of the public that, for example, the largest research council (SERC) spends appreciably more on its subscription to CERN than it contributes to the whole of Chemistry. Indeed the funding of Big Science involves an expenditure nearly three times that devoted to Chemistry. There is a strong argument for transferring the responsibility for funding Big Science, especially in relation to international commitments, away from the existing SERC—perhaps to become the direct responsibility of central government (ie OST).

Q.3 *What are the relationships connecting government funding of the science base, funding by industry and charities, and overseas funding (particularly from the EEC)? Are they calling different or incompatible tunes?*

The multiplicity of funding sources is to be welcomed in avoiding the dangers inherent in too great a concentration on a limited range of topics in a limited number of centres. But with the growing volume of EC funding of science and technology the Government should seek to ensure that this Framework Programme funding dovetails with national UK science policy objectives.

The range of funding sources encompasses a range of missions. These are different and where they overlap, for example between the RCs and Government departments, the science is usually of a high priority. Examples here include Global Environmental Research and Molecular (ie chemistry-related) Biology.

The funding available from the EC, which is of increasing importance for HEIs, is highly focused and proactive in most cases and is also frequently and strongly linked to industry.

EC funding ranges from strategic to applied research which may often have a medium-to-short time scale outlook. In those areas of Government funding that do not overlap or only partially overlap with RCs there is a tendency for the work to be very short term. Indeed there is a discernible tendency to produce new short term initiatives with alarming frequency. [It is also a cause of real concern that, while it has long been "Government Policy" that contract research carried out at HEIs should be "fully funded", it has frequently been almost impossible to extract reasonable overheads from Government departments which have generally been more resistant than industry to make such contributions.]

Charities are also a most important source of funding, though in a limited area, for the science base (see below).

Industrial support directly to HEIs tends to be of two very distinct kinds. Large industrial concerns may provide some funds for quite basic ("blue sky") research, targeted at individuals or individual establishments. This may be related to particular projects or achieved via the provision of fellowships. Small industrial concerns (but some large ones also) are more willing to provide funds for highly targeted projects often of a near-marketplace type. It is a cause of concern to some that HEIs are being pushed to be involved in this type of research which at the same time is thought to be inappropriate for Government supported research institutions.

A major input of industrial/commercial funds for research comes via co-operative ventures partly funded by the EC.

There are some disadvantages in having multiple funding "agencies". These relate to some incompatibilities which produce excessive administrative and opportunity costs. The potential research applicant has to spend much time learning the "rules" of the different agencies. [As a result a whole industry has developed, especially in relation to EC grants, of consultants, liaison officers and the like. They exist to distribute information about what areas of support are available, and provide expertise in form filling and linking of groups etc., to increase the chances of success in research grant application.]

All this means that less money is effectively available for the actual research. Indeed, in some cases the huge number of applications for particular projects or initiatives, with the consequently small success rate, may mean that the real and opportunity costs are a significant fraction of the sum available for the actual research. This is not a cost effective way of proceeding and all indications are that the situation is worsening.

It is difficult to ensure that the total distribution of research funding among the various research areas is consistent with any particular plan of the Government within a multiplicity of funding sources. This is in no way undesirable since in its nature the outcome of particular research is so difficult to predetermine. Nevertheless it is important that sufficient information is available centrally—which is a role that could be performed by the OST—about the totality of funds and their distribution, to prevent excessive and unintentional concentration in particular areas, or the obverse.

Q.4 *What information and advice is needed by those who are setting priorities? How do they know what is going on in current low-priority fields? How do they track developments overseas?*

While for most long-term research the priorities are set by the researchers themselves there is clearly a need for Government to play a key part in monitoring the full range of science and technology research, both domestic and international, and provide up-to-date information about developments.

Priorities are set by the various "funding agencies" in a very diverse set of ways. For research councils (in the case of Chemistry, particularly the SERC) priorities are set by the Council and Boards and their subject committees, all of which have strong representation from active scientists and engineers. Peer review not only controls the distribution of funds at the subject committee level but also informs the higher levels.

While this system is not run by administrators, worries exist that some of the very senior scientists inevitably involved in the decision making may themselves be too far removed from the laboratory. This is likely to be more of a problem with decisions about priorities relating to proactive research as against the support of responsive mode funding.

Another concern is the Government itself is likely to receive advice from the same group of people wearing different "hats". It is possible that attempts should be made to obtain a wider spread of those providing input (perhaps asking for input from the Research Committees of HEIs and the learned societies).

There is a distinct impression that Government and Industry do not monitor closely what goes on overseas. Nevertheless research priorities thought to be of national importance and prime cases for proactive funding are remarkably similar among the major industrial countries. Responsive mode funding, where priorities are to a large extent set by very active researchers, appears to be remarkably international in its outlook. This indicates that those kinds of researchers are able to track scientific developments throughout the world with no difficulty.

If a field has been given a low priority in the proactive mode, but starts to become a significant area scientifically, there will undoubtedly be a rapid rise in requests for funding. This is not perceived as a serious problem. There can surely be no doubt that even if, for example, no decision had been made to give special support to the subject of "high temperature superconductivity" a very large number of research proposals would have been submitted by Chemists, Physicists and Material Scientists! [There is no doubt either that, prior to the report from the IBM research laboratory in Zurich, it was at all likely that any committee would have recommended the area as one to receive high priority.]

The conclusion is that for most long term basic research the priorities are set by the researchers themselves. The advice required comes from contact with them and what is required is the ability of the support system to react rapidly to the emergence of new developing research areas.

Q.5 *How do charities and companies which fund research set and implement priorities? How is it done overseas? Are there lessons here for the government?*

Although the Royal Society of Chemistry is itself a registered charity with a commitment under its Royal Charter "to serve the public interest" it does not itself directly fund research.

Charities and companies which fund research generally have highly defined remits. Indeed, in the case of charities they probably have terms of reference which severely limit their freedom of choice. They support research which they perceive will further their (usually relatively narrow) objectives. As a result this kind of funding is, in the main, highly directive.

In this country those charities that produce substantial sums of money for research are principally medically orientated. From the point of view of Chemists this means that the funds for which they may compete from these sources are mainly associated with the synthesis of compounds likely to have potential as pharmaceuticals. In this respect, the funds available from drug companies fall materially within the same area.

However charities can have longer time horizons than companies and their contributions can be important for the support of some kinds of long term basic research. Companies not only have a relatively short time horizon but are also, in this country, very sensitive to the economic situation. Thus the recession of the past few years has seen a substantial decrease in support for research.

In Japan and in the rest of the EC, research appears to have a rather longer time horizon which may be related to taxation policy or more fundamental social policies. Companies cannot be expected to support research (for example, in HEIs) which is related to the Science Base if they believe it might reduce their competitive advantage vis a vis other companies, especially where they feel it would not be possible to have priority use of the research findings.

It is unlikely that the experience of charities and companies in setting their priorities, bearing in mind the limited nature of their remit, can have general applicability for the Government. But for the narrow area in which they do operate they may provide useful examples of how they assess the effectiveness of their funding activities.

Among the problems which have arisen in regard to Chemistry-related research (most notably in relation to the Human Genome Project)—where central Government needs to be involved in international discussions—is the issue of copyright and patenting.

Conclusion

The Society recognises the timeliness of the Select Committee's inquiry into "Priorities for the Science Base" despite the fact that some of its original Questions have been somewhat pre-empted by the contents of the Government White Paper. There is much in that White Paper which the Society supports although there are some areas of concern in regard to the new Research Councils.

The Society also recognises the valuable role which the Select Committee has performed over many years in consistently seeking to highlight science and technology issues and policy at a time when it was not politically very fashionable to do so.

The Society welcomes the return of science and technology policy towards the centre of the political stage. This can only be good for science in the long run. Whatever the priorities of the science base may be there is a continuing need to strengthen the public understanding of science. No scientific activity can afford to ignore the importance of a greater level of public understanding of science. A weak public understanding of science threatens public support for the resources that science needs.

The public understanding of science is a priority for the science base.

List of Attachments to this Submission

The following attachments are included with this submission by the Royal Society of Chemistry:

- Copy of the Letter from the Secretary General of the Society Dr T D Inch to the Chancellor of the Duchy of Lancaster conveying the Society's initial response to the publication of the White Paper "Realising Our Potential: A Strategy for Engineering, Science and Technology".
- Copy of the Letter from the Secretary General of the Society Dr T D Inch to Sir David Phillips of the Office of Science and Technology conveying the Society's views of the chemistry community on the proposed structure in the White Paper of the new Research Councils.
- Copy of the Letter from the Secretary General of the Society Dr T D Inch to the Chancellor of the Duchy of Lancaster conveying the Society's subsequent response to the proposals in the White Paper relating to Post Graduate Education.

Letter from the Secretary General to the Chancellor of the Duchy of Lancaster, 7 June 1993

I am writing on behalf of The Royal Society of Chemistry to say how much the Society welcomes the long-awaited publication of your White Paper "Realising Our Potential: A Strategy for Science, Engineering and Technology".

It is a document that has certainly been responsive to the many representations you received including contributions from learned societies such as ours, and it provides an excellent focus for the continuing national and Parliamentary debate in which this Society certainly intends to take an active part.

We at The Royal Society of Chemistry are giving the White Paper very serious consideration and are convening an extraordinary meeting of our Scientific Affairs Board to discuss it, at which we plan to involve leading chemists from both academia and industry.

However I should like to take this opportunity to respond to some of the points you raised in your Statement, in exchanges across the floor of the House, and in the White Paper itself. The Royal Society of Chemistry is anxious to forge a constructive partnership with your Department in many areas. For example:

1. *The Public Understanding of Science*

As you know, The Royal Society of Chemistry takes a strong interest in seeking to promote the wider and better public understanding of science. For some time we have been increasing our activities in this area in trying to further our Charter commitment "to serve the public interest". For example, we have recently been discussing with COPUS and The Royal Society how to make the City and financial institutions better informed about science and its relationship to wealth creation. We have every wish to work closely with others to get more from our resources.

The Society is also anxious to participate actively in your Department's "new campaign" to spread the understanding of science and technology in schools and amongst the public. We would like to hold talks with your Department about ways in which we could cooperate (and I attach a list of some of the Public Affairs activities which the Society has pioneered—*not printed*).

2. *Education in Chemistry*

As you know the Society takes an active lead in the promotion of Chemistry at all levels within the education system. We have a significant track record in contributing to teacher and student training, in addressing curricula content, in encouraging and motivating teachers, in setting standards and qualifications and in other areas. (I attach a summary for your information—*not printed.*) We would wish to continue in these activities but add leverage to our efforts by better coordination with other groups sharing a similar purpose, perhaps through your Department.

3. *Policy Issues in Chemistry*

In your Statement you refer specifically to the National Academies Policy Advisory Group. This is a forum in which the Society would like to be involved. We have now established a Scientific Affairs Board precisely for the purpose of enabling the Society to devote attention to national chemistry issues. I hope you will agree that—where chemistry is concerned—The Royal Society of Chemistry is well organised and properly staffed to provide you and your Department with the authoritative and independent advice which you have indicated you are seeking.

4. *Technology Foresight*

On this topic we are a little unclear on what can be achieved although we welcome the attempt you wish to make to stimulate open discussion of future prospects. However we would like to be involved in the new procedures outlined in the White Paper as we believe that the many specialist subject groups in The Royal Society of Chemistry could be ideal for detailed analyses of any general targets for future research that are suggested. (I attach a list of these groups, some of which could dovetail with those being set up by your Department for Technology Foresight (*not printed*).) We believe that many advances in science and technology, and the future prosperity of the UK, rest on a basis of Chemistry.

5. *Structural Changes in the Research Councils*

I must alert you to the fact that many of our most senior members—from both academia and industry—are uneasy that the changes you have announced in the structure of the Research Councils may restrict the funding given to many chemists who work in areas which span chemistry and biology. This is a concern which was raised with you in the House by Sir Trevor Skeet MP and was also implicit in the exchange you had with Donald Anderson MP.

Biological research continues to have an increasing chemical content. Most of the advances in our knowledge of proteins, genes, DNA, RNA and recombinant techniques now depend on chemists. Furthermore, bio-inorganic chemistry is of increasing importance. The application aspects of biotechnology which are needed if commercial viability is to be achieved depend more on chemists and chemical engineers than on biologists.

Obviously, procedures to avoid these "overlap" problems can be introduced. In regard to some of the organisational changes which you have announced we would like to be involved in the work of the committee which you have set up under the chairmanship of Sir David Phillips to examine the exact allocation of the transfers of chemistry-related funding from the old SERC to the new BBSRC.

However I must convey the genuine concern that, since overall funding is not being increased, the new structure, taken together with historical vested interests, will be very much to the detriment of many areas of middle-ground chemistry-based research where we know we can expect very exciting new advances with high applied potential.

6. *The Support of Basic Research*

One further area of concern, linked with the above, which I would also like to raise at this stage concerns the role of the new EPSRC. According to the White Paper the EPSRC seems likely to become one of the main vehicles for "wealth creation" with the emphasis placed upon "meeting the needs of the users of its research".

The Society has a concern that chemistry-based seminal research could become underfunded in an EPSRC "environment" which was deliberately tilted too far towards "mission orientated" projects.

This concern arises out of our experience that many of the really important and "wealth creating" developments based on Chemistry—such as lasers, liquid crystals for display devices, and catalysts—have been the products of good scientists being allowed to follow through very fundamental ideas which at that stage were not obvious wealth creators.

Invitation to Address the Society's Parliamentary Links Day

As you know, The Royal Society of Chemistry has long taken an active role in raising the awareness of science—and seeking to improve the level of information about scientific issues—with Members on all sides of the House. The Society has expanded its pioneering LINK Scheme in the new Parliament and has provided

MPs with background briefing material on a wide variety of science and chemistry issues arising over the past year.

We would like to take this opportunity on behalf of the Society to extend an invitation to you to address the Society's "Parliamentary Links Day 1993" which this year is being held on Tuesday 6 July. [You will recall that you were able to look in on our Links Day last year—and this was much appreciated.]

Links Day is again being held at the House—in the Jubilee Room between 10.30 a.m. and 12.45 p.m.—and we would welcome your remarks at any time convenient to you that morning. By happy coincidence this event takes place in the very week that HOUSE Magazine is planning to devote its main feature to your White Paper and the ensuing debate and discussion of Scientific policy.

While we appreciate that you have a very busy Ministerial schedule the Society would be very pleased to welcome you to this occasion which would provide you with a useful opportunity to convey your message to an audience of distinguished chemists, Peers and MPs with an interest in science from all sides of the House.

In conclusion, we hope that the publication of the White Paper can release much of the constructive energy that needs to be put into retaining and enhancing the UK as a world leader in science. On behalf of The Royal Society of Chemistry we look forward to working with you and your Department to this end.

Letter from the Secretary General to Sir David Phillips, 8 July 1993

On 7 July, the Royal Society of Chemistry held an extraordinary meeting of its Scientific Affairs Board to discuss Mr Waldegrave's White Paper. Also attending the meeting were very senior representatives from industry, the Institution of Chemical Engineers and the Chemical Industries Association.

I am writing now to express the views of this chemistry community on the research council structure. I have to say that the views expressed were exceptionally consistent almost to the point of unanimity.

Underlying much of the discussion were the following major concerns:

(1.) As we better understand mechanisms at the molecular level, chemistry is increasingly important to all branches of science from biology to materials and solid state science. For chemistry therefore, the only truly satisfactory organisation is a single body where its all-pervasive importance could be fully recognised. The structure that has been put in place runs counter to this reality.

(2.) In some quarters there is a view that chemistry in the UK is healthy and needs less nurturing by government than some other areas of science. This view must be resisted. Our chemical industries, although still profitable, are under increasing competition and will need every help from a strong science and technology infrastructure to retain long-term profitability.

The meeting, recognising that there was little scope for major changes in the proposed structure, concentrated on the mechanisms that could be put in place to ensure chemistry would not be disadvantaged. The main points are the following:

1. *Role of Director General*

The Director General should have real power over the research councils. To have the power required he must be the accounting officer. If he is not a chemist, then he must be advised by senior chemists on the allocation of funds for chemistry to the various research councils.

2. *Representation on Councils*

If chemistry is not to become a poor relation, each research council must contain a significant proportion of chemists. We will be writing soon to put forward names of experienced chemists who we believe have the vision and independence of view to help set the right standards on the new councils.

We understand that you have already addressed some of our concerns about separating biotechnology from chemistry and the physical sciences, and are proposing a joint committee for biomolecular sciences. We are uncertain whether this goes far enough for the increasingly multidisciplinary biotechnology area. At our meeting the view was expressed that, in the past, joint committees have often been unsuccessful and we stress that the Director General will need to take a very positive role if this is to work properly. However, since you are recommending a joint committee for biomolecular sciences we have to ask why some of the other components of biotechnology are not treated in a similar way. Our chemical engineering colleagues, in particular, as well as chemists feel that their role in creating wealth from biotechnology is more critical than that of the more biological scientists. Further, the stimulus to research of the problems which are arising in biotechnology is essential to the well being of much of chemical engineering.

We also understand that you are suggesting transferring carbohydrate chemistry from SERC to BBSRC. We do not understand why you should wish to separate this part of organic chemistry from the bulk of the topic.

In this note I have concentrated on our concerns. I also have to tell you that most present also saw opportunities and new challenges and were very positive in their desire to work with the new system and to make it work. This is certainly the view of the Royal Society of Chemistry and we have offered our services in whatever ways are appropriate.

You may also be interested to know that there was enormous cynicism about the effect on the small science budget of splitting big science into the PPARC. The view was taken that this did not benefit small science, it just shifted the decision point.

I hope you find the above comments helpful in finalising your recommendations.

Letter from the Secretary General to the Chancellor of the Duchy of Lancaster, 21 July 1993

On July 7 1993, The Royal Society of Chemistry held an extraordinary meeting of its Scientific Affairs Board to discuss the White Paper. Also attending the meeting were very senior representatives from industry, the Institution of Chemical Engineers and the Chemical Industries Association (you may wish to note one very positive effect of the White Paper is that it is stimulating those of us concerned with chemistry to try and get our act together).

In particular, we gave attention to two major concerns:

1. *Boundary Issues for Research Councils*

On this we have written separately and with some urgency to Sir David Phillips. I need say no more here.

2. *Post Graduate Education*

The unanimous view of our meeting was that the proposals for a one year MSc degree really had not been thought through.

The following points were made:

- It is quite wrong to think that the format for post-graduate training needs to be the same for all subjects. The requirements for chemists may differ from physicists which may also differ from biologists or engineers.
- A one year MSc course in a specialist area is unlikely to prove a suitable foundation for a PhD in chemistry. Certainly, such a taught course would not assist in the selection of suitable candidates for PhDs.
- To reduce the number of PhDs in chemistry was not considered a good plan. There is no evidence that there is oversupply in chemistry. Research in chemistry depends on the number of students probably more so than in physics and engineering.
- We should never forget that many of our best teachers of chemistry in schools have PhDs. We should do nothing to make it more difficult or prolonged for a potential teacher to get a research degree.
- The introduction of MSc as suggested could shift the balance of the activities of university staff from research to teaching. Is this intended and in the longer term who would teach the MSc courses?
- As is stated in the White Paper not all BSc courses are adequate for subsequent PhD studies. There is room for MSc conversion courses for those with a BSc that does not fully provide the background for the PhD they wish to undertake.

There were many other closely related points.

We have great difficulty in separating arguments for and against an MSc from arguments about a 3 or 4 year degree which in turn are difficult to separate from the debate on the pros and cons of a narrow or broad 16+ education. We really have to consider all the issues together.

At the Royal Society of Chemistry we have in progress or have completed studies on all these issues. We certainly favour diversity but recognise that we must also achieve quality.

We would like to know now how you think we can best put our specific perspective on chemistry into the wider debate on science. How is the debate on postgraduate education in science to be carried forward?

Letter from the Science and Engineering Research Council

When you circulated the draft transcript of Research Councils' evidence given on 21st October you noted that some of the prepared list of questions were not covered and invited answers in writing. Sir Mark Richmond has asked me to reply.

You will appreciate that parts of the questions are really addressed to the new Councils and it would be inappropriate for the SERC to guess how, say, EPSRC or PPARC would respond. I am afraid the Committee will have to wait for the Chairmen and Chief Executives of these bodies to be appointed and for staff to be assigned to them before definitive answers can be given. With that background I make some comments on the outstanding questions below.

4. *How do you read your new Mission Statements? How do you intend to act upon the requirement to "enhance the UK's industrial competitiveness"? (For instance, in considering grant applications, do you envisage a "first cut" for excellence followed by a "second cut" for industrial interest as intimated to us by Mr Waldegrave on 13 July?)*

The interpretation of the Mission Statements and the actions to "enhance the UK's industrial competitiveness" are for the new Councils to decide when they are created.

5. *Does the Science White Paper change the position of basic science in the Mission of each Council? Dr Geoffrey Robinson of DTI told us on 16 June that a preference for market oriented research, as signalled by the White Paper, is not in conflict with your historic commitment to basic research: do you agree?*

We agree with Dr Robinson that the important position of basic science does not *have* to change as a result of the Mission Statements. However the key question is not the importance of the role of basic research, but how much funding can be diverted to it within constrained budgets. The balance of funding between basic, strategic and applied research is for the new Councils to decide when they are created.

10. *In the post White Paper era, do you expect your relations with your "customer" Government Departments to be different? What new "concordats" are being drawn up? Do you all expect to enjoy a closer relationship with the DTI, and to what end?*

EPSRC's closest "customer" Department will be the DTI. PPARC does not have any Department which is so obviously its customer. The SERC's main customer Department has clearly been the DTI and the Council has been preparing with the DTI the draft of a concordat. This has been aimed not so much at bringing about a closer relationship with the DTI (SERC and DTI already have many joint activites) as at regularising the existing contact between the two organisations so as to make their interaction more informed and more efficient. The draft text of the concordat will be handed on to EPSRC for it to build upon at which time it may also consider the benefits of similar concordats with other government departments within which it will have important (but lesser) contact.

12. *Is there anything particular which you hope to see in your new Charters?*

We would expect the Charters for the new Councils to be consistent with their Mission Statements. As the SERC is at the moment the only Research Council to have the task of improving the public understanding of science and technology in its Charter we would also hope all the Councils would have specific reference to this in their new Charters. Our understanding is that both these points will be taken care of by the OST in the drafting of the Charters.

If the Committee would like me to amplify any of these statements please let me know.

John Merchant

17 November 1993

Letter from the Higher Education Funding Council for Wales

Thank you for your letter dated 19 November 1993. I can provide the following answers to your queries. Please note that science and technology includes medicine.

(1) Out of a total of £38.317 million distributed by the HEFCW for research, £23.715 million has been allocated to science and technology subjects.

(2) The Council requires institutions to submit five year strategic plans and to update them annually. However, it does not intend to use these documents for research accounting purposes. The Council will require institutions to account for the allocation, as opposed to the expenditure, of their recurrent grant for research and is currently considering the most sensible and practical way in which this might be done.

(3) I list below the numbers of students and full-time academic staff for the University of Wales associated with science and technology subjects (source USR).

	Research Students FT	*Research Students PT*	*Staff All*
Total	1,348	323	3,428

I hope this provides all the information you require.

John Andrews

Chief Executive

3 December 1993

LETTERS FROM DEPARTMENTS ABOUT THE FORWARD LOOK AND EDX/PES CYCLES

Letter from the Ministry of Agriculture, Fisheries and Food

In your letter of 6 August to my predecessor, you asked how MAFF envisaged interacting with the Office of Science and Technology in the Forward Look cycle and the EDX cycle.

This Ministry welcomes the Forward Look concept. As a science-based Department with considerable requirements for research in pursuance of its policies, the Ministry readily recognises the importance both of a strategic approach and of consultation and communication. Since 1991, the Ministry has published sectoral strategies, and this year also intends to publish a general scientific strategy, to provide an indication for contractors and others of the Department's plans. In determining its policy requirements for science, the Ministry consults widely and takes account of advice from independent representatives of industry, academia and consumers as well as from other government departments.

This strategic approach to formulating its scientific requirements, along with its commitment to publication, will enable MAFF to contribute readily and positively in the Forward Look cycle, which forms a logical progression from, and a natural complement to, the process of departmental policy formulation. In the first year particularly, a good deal of preliminary consultation between the OST and other government departments is bound to be needed to determine the format, content and presentation. MAFF will participate fully in this process.

Similarly, MAFF will participate along with all other departments in the EDX cycle. The OST, and especially the Chief Scientific Adviser, will have a particular role in informing this process. MAFF's participation in their Forward Look cycle, and close liaison generally, will ensure that its departmental priorities can be taken fully into account in the Government's determination collectively of the appropriate allocation of resources.

Angela Evans
Parliamentary Clerk
20 September 1993

Letter from the Ministry of Defence

Thank you for your letter enclosing the transcript of evidence given to the Select Committee by the Chancellor of the Duchy of Lancaster on 13 July.

The Department welcomes the idea of the Forward Look and is collaborating closely with the Office of Science and Technology in its preparation of the first such report.

As regards the EDX cycle, the Department is of course fully involved in the annual public expenditure round, and as part of this process provides the Chief Scientific Adviser with information on the science and technology content of its expenditure bids.

Miss S J Ambler-Edwards
Private Secretary
6 October 1993

Letter from the Department of the Environment

I am replying to your letter of 9 August to Mr Bailey here, covering the transcript of evidence given to the Select Committee by the Chancellor of the Duchy of Lancaster. As requested, the transcript has been drawn to the attention of the Permanent Secretary.

Your letter conveyed Lord Flowers's question on how it was envisaged that Departments including the Department of the Environment, would interact with the Office of Science and Technology (a) in the Forward Look cycle and (b) in the EDX cycle.

The Department expects to make a full contribution to the preparation of the first and subsequent Forward Looks. As explained in the White Paper, their preparation will be led and co-ordinated by OST making full use of the submissions made by Departments and the Research Councils on their research plans. The Department's contribution will reflect the research we need to fulfil our new mission statement. It will reflect future policies as laid out in relevant White Papers. It will also need to take into account the impact of the EC Fourth Framework Programme on our future programme expenditure. In the future, the Department will also be able to draw on the strategic objectives and priorities identified in the previous year's Forward Look in considering any need to adjust the Department's research plans. We believe that the opportunity for interaction between the Forward Look of the Research Councils and Departments will be particularly fruitful. The Department will expect the EDX cycle to involve similar interactions, and welcome the involvement of the CSA in the process.

It will undoubtedly take a little while for full benefit of the new procedures to be felt. DOE is committed to their full development.

Fiona Cruickshank

Central Policy Planning Unit

8 October 1993

Letter from the Department of Health

You wrote on 9 August asking me to draw to the attention of my Permanent Secretary the transcript of evidence given to the Select Committee by the Chancellor of the Duchy of Lancaster on 13 July, with particular reference to questions 34 to 37. You said Lord Flowers would be grateful for a written answer to a question about how we envisage the department interacting with the Office of Science and Technology (OST) in the Forward Look cycle and in the EDX cycle.

The Department considers that the Forward Look will play a crucial role in implementing the White Paper strategy. It will relate specific programmes funded by departments to the Government's overall strategy, a process which will be reinforced by the Technology Foresight Programme. The Department will be playing an active part in the Forward Look process through its membership of the relevant official committees and will be working closely with OST in the coming months on the Department's own contribution to the first Forward Look.

The White Paper makes it clear that, over time and reinforced by the results of the Technology Foresight Programme, the Forward Look will form the basis for better informed decisions between competing priorities, which can in turn inform decisions taken during annual public expenditure surveys. Effective interaction between departments and OST in the EDX cycle will be an important part of this process. After consultation with departments, the Chief Scientific Adviser provides advice on the S&T elements of departments' bids, assisting EDX to form a view on the total allocation of expenditure to departments. Following the publication of the White Paper, the Chief Scientific Adviser met Professor Peckham to consider the Department's research spending in the context of the annual expenditure round. The Department found this dialogue helpful and looks forward to its continuation as part of the EDX cycle.

The Department's commitment to both the Forward Look and effective input to the EDX cycle was reflected in the evidence Professor Peckham gave to the Select Committee on 16 June and in the revised version of the Department's "Research for Health" which was published on 29 June, and a copy has been sent to the Select Committee.

I hope this is helpful.

Trish Fretten

Parliamentary Clerk

1 October 1993

Letter from the Scottish Office

Thank you for your letter of 4 August and copy of the transcript of evidence given to the Select Committee by the Chancellor of the Duchy of Lancaster, which has been drawn to the attention of our Permanent Secretary.

Your letter poses two questions. I will, if I may, turn my attention first to the Forward Look cycle. The Scottish Office will be involved in the Forward Look cycle by participating in inter-departmental meetings and contributing written statements of our plans to OST. We shall also be commenting on papers prepared by other participants to the Forward Look and contributing to discussions. In all these activities we will draw on our networks of contacts in industry and research throughout Scotland. In due course, the Scottish Office will work with OST to promote and disseminate the findings of the Forward Look exercise.

As to the EDX cycle we will have discussions with OST as appropriate. Already the Chief Scientific Adviser has met with our Principal Finance Officer and we hope to continue the dialogue.

E. B. Miller

1 October 1993

SUPPLEMENTARY INFORMATION FROM THE RESEARCH COUNCILS

Letter from the AFRC

Thank you for your letter of 19 November 1993 requesting supplementary information for the above. I hope the response given below is helpful:

1. The number of research scientists employed directly by AFRC as at 1 April 1993

AFRC Institutes	2,118
HRI	38
TOTAL	2,156

2. A list of the universities where most of AFRC research grants are situated is attached (*not printed*). As almost all grants provide for staff it follows that this is where most are concentrated.

3. In assessing applications for standard three year research grants AFRC does not usually take into account RAE rating of the department. The main criteria are scientific excellence of the proposal and the track record of the individual principal investigator to produce good work. The RAE rating is taken into account when AFRC is considering setting up a large group or unit which carries with it significant investment over a number of years. The RAE rating is also taken into account in the allocation of AFRC research studentships and fellowships.

Avice Morris

Head, Council Secretariat

29 November 1993

Letter from the ESRC

Thank you for your letter of 19 November. The answers to the questions raised are set out below:

1. The ESRC does not directly employ any research scientists.
2. Over 95 per cent of the research scientists whose work ESRC supports are employed by universities. The 12 main university recipients of funding for research accounted for 49 per cent of all ESRC funding for research over the two years to March 1993 (although this is an outcome, not a deliberate policy). We are able to both count and list the universities most important to the ESRC, although direct information by number and grade of scientists supported is not readily available.
3. The ESRC only takes account of the Research Assessment Rating for very large project support, ie 10-year-funded Research Centres, 5-year-funded Resource Centres.

All the above information can be made freely available. Please let me know if the Sub-Committee requires further information.

Professor Howard Newby

Chairman

3 December 1993

Letter from the MRC

Thank you for your letter of 19th November. The answers to the questions posed in your letter are:

1. The MRC employs 1,130 research scientists (who are clinically or scientifically qualified) and 1,228 research support staff in its institutes and units.
2. Research scientists employed by universities can be supported through our grants schemes. Research grants are distributed across a large number of universities and institutes, over 70 at the last count. Of the 1,212 grants of all types in existence in universities in September of this year, 113 (9 per cent) were at Oxford University, 100 (8 per cent) at Cambridge University, 99 (8 per cent) at University College London—including those at University College and Middlesex School of Medicine—and 72 (6 per cent) at the University of Edinburgh. We can provide a complete list of universities and institutes receiving MRC grants if you would find this useful.
3. When assessing applications for grants support, the strengths (or otherwise) of a department are taken into account—the rating from the Research Assessment Exercise does not normally form part of the assessment. The MRC awards around 330 project grants (for up to three years) per annum. Committee members are asked to take the following considerations into account.

(i) the potential value of the application both in practical terms and in relation to the relevant field of knowledge;

(ii) the appropriateness of the overall project design;

(iii) the suitability of the methods proposed, and

(iv) the applicant's ability to do the work with the resources requested and within the time proposed.

Similar criteria are used in the assessment of applications for long-term support, however, in such cases, the strategic implications of the proposed work become an important consideration.

I hope you find this response helpful.

Letter from the NERC

Thank you for your letter of 19 November requesting further information for this enquiry. The answers to your questions are as follows:

1. We have interpreted this question in terms of the number of science grade staff employed directly by NERC. For the month ending 31 October this was 1498.5 (excluding 26 science grade staff employed at the Swindon office).
2. Support to universities is listed by university in the NERC Annual Report each year. I attach a copy of the listing for 1992-93 from the latest Annual Report which will be published on 7 December (*not printed*).
3. NERC does not take into account the UFC rating of the department when assessing grant applications. The UFC has taken the number of successful research council grants as an important criterion in determining their grade of assessment. If we then, in turn, use that grade to decide whether to award a research grant we would be completing a circular argument, which we feel would be indefensible. It is nevertheless true that applications from grade 5 departments are quite frequently successful; that is because of the strength of the applications and the staff writing them, rather than any pre-selection process.

I am content for all parts of this response to be made public.

Dr Eileen Buttle

Chief Executive (Acting)

3 December 1993

Printed in the United Kingdom by HMSO
19585 C5 1/94 136431 PP

ISBN 0-10-481194-3

9 780104 811948

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